APT-17

2017 South Carolina Pest Management Handbook

CLEMSON
COOPERATIVE EXTENSION

Table of Measurements and Conversions

Standard Measure	Metric Conversion
Length: 1 ft = 12 in 1 yd = 3 ft 1 mi = 5,280 ft 1 mph = 88 ft/1 min	**Length:** 1 in = 25.4 mm = 2.54 cm 1 ft = 304.8 mm = 30.48 cm 1 yd = 914.4 mm = 91.44 cm = 0.914 m 1 mi = 1,609 m = 1.61 km 1 mm = 0.03937 in 1cm = 0.394 in = 0.0328 ft 1 m = 39.37 in = 3,281 ft 1 km = 3,281 ft = 0.621 mi
Area: 1 sq in = 0.007 sq ft 1 sq ft = 144 sq in 1 sq yd = 1,296 sq in = 9 sq ft 1 ac = 43,560 sq ft = 4,840 sq yd	**Area:** 1 sq in = 6.45 sq cm 1 sq ft = 929 sq cm 1 sq yd = 8,361 sq cm = 0.8361 sq m 1 ac = 4,050 sq m = 0.405 h 1 sq m = 1,550 sq in = 10.76 sq ft 1 h = 107,600 sq ft = 2.47 ac
Volume: 1 tsp = 0.17 fl oz 1 tbs = 3 tsp 1 fl oz = 2 tbs = 6 tsp 1 cup = 8 fl oz = 16 tbs 1 pt = 2 cups = 16 fl oz 1 qt = 2 pt = 32 fl oz 1 gal = 4 qt = 8 pt = 128 fl oz = 231 cu in Note: To convert liquid ounces to gallons, multiply by 0.0078125(.008)	**Volume:** 1 fl oz = 29.5 ml = 0.0295 L 1 pt = 437 ml = 0.437 L 1 qt = 945 ml = 0.945 L 1 gal = 3,785 ml = 3.785 L 1 ml = 0.033 fl oz 1 L = 33.8 fl oz = 2.112 pt = 1.057 qt = 0.264 gal
Weight: 1 oz = 0.0625 lb 1 lb = 16 oz 1 ton = 2,000 lb 1 gal of water = 8.34 lb	**Weight:** 1 oz = 28.35 g 1 lb = 454 g = 0.4536 kg 1 ton = 907 kg 1 gal of water = 3.786 kg 1 g = 0.035 oz 1 kg = 35.27 oz = 2.205 Lb
Concentration: 1 part per million (ppm)= 0.00001 percent = 0.013 oz in 100 gal of water 1 percent = 10,000 ppm 0.1 percent = 1,000 ppm 0.01 percent = 100 ppm 0.001 percent = 10 ppm	**Concentration:** 1 part per million (ppm)= 1 milligram/liter = 1 milligram/kilogram 1 percent = 10 grams/liter 0.1 percent = 1,000 milligrams/liter 0.01 percent = 100 milligrams/liter 0.001 percent = 10 milligrams/liter
Temperature: To convert degrees Celsius (°C) to degrees Fahrenheit (°F): multiply by 1.8 and add 32. Example: 30 degrees °C = 86 degrees °F. (30x1.8+32) To convert degrees Fahrenheit (°F) to degrees Celsius (°C): subtract 32 multiply by 0.56. Example: 50 degrees °F = 10 degrees °C (50-32x0.56).	

Abbreviations: ac = Acre; cm = Centimeter; fl oz = Fluid ounce; ft = Foot or Feet; g = Gram; gal = Gallon; h = Hectare (1h = 10,000 square meters); in = Inch; kg = Kilogram; km = Kilometer; L = Liter; lb = Pound; mi = Mile; oz = Ounce; pt = Pint; m = Meter; mg = Milligram; min = Minute; ml = Milliliter; mm = Millimeter; qt = Quart; sq = Square; tbs = Tablespoon; tsp = Teaspoon; yd = Yard.

2017 South Carolina

Pest Management Handbook

The Pest Management Handbook is a set of recommendations developed by Clemson University Extension pest management specialists and university researchers for South Carolina growers. These recommendations were derived from various sources of information available to these contributors at times prior to publishing this handbook and represent their current views on managing field crop pests based on pesticide labels, their own research or experience, and/or a number of other sources. The chemical recommendations provided here are based on pesticide active ingredients. Pesticide products mentioned here are for applicator convenience and are examples only; their mention is not product endorsement. Pesticide products not mentioned here may also be efficacious and their absence from these recommendations does not necessarily mean that they are not also effective pest management tools. These recommendations are not meant to be an exhaustive recommendation, and associated comments, given here are in all cases are superseded by the pesticide product labels. It is your responsibility as a pesticide user to read and follow the instructions on the product label in deciding your pesticide purchases and in their use, including mix/loading of the product, application, clean-up, and the disposal of unwanted product, rinsates, and clean empty product containers.

The 2017 Pest Management Handbook is also available as an electronic copy on the Clemson University Extension web site under Row Crops section. The web site address is:

http://www.clemson.edu/extension/rowcrops/

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INTRODUCTION

SPRAYER CALIBRATION

Mike Marshall, Extension Weed Specialist

Accurate application of pesticides is essential to adequately control target pests, avoid excessive crop injury, and minimize chemical costs and harm to the environment. This has become even more critical in recent years as some pesticide use rates go from pounds per acre to fractions of one ounce per acre. Unfortunately, sprayer calibration is often neglected or avoided. There are many ways to calibrate a sprayer, some more difficult than others. If you have a reliable method with which you are comfortable, stick with it. The following is a guide to a straightforward method.

Sprayer calibration should be done with clean water, *not with the chemical mix in the spray system*. Before you calibrate your sprayer, thoroughly clean it. Also, be sure to check for nozzle output uniformity, as defects or uneven wear will cause some nozzles to put out significantly more than others of the same type. To do this, catch and measure the output of *each* nozzle for a specific length of time (30 seconds, 1 minute, etc.) and determine the average output per nozzle (total combined output of all nozzles divided by the number of nozzles). Discard and replace any nozzle that varies more than 5 percent from the average.

1/128 acre method:

This is perhaps the most frequently used and quickest method of calibration. It involves measuring a specific driving distance rather than an area. Follow these steps to calibrate by the 1/128 acre method.

1. Measure a specific distance in a field according to **table 1**. Select a driving distance which matches the nozzle spacing on your boom (for broadcast sprays) or row spacing you use (for band applications). The distance should be measured in a field typical of those you will be spraying, rather than a smooth surface.
2. Select a gear and engine speed combination which will allow you to comfortably drive across your fields and develop adequate spray pressure for the particular nozzles on your rig. Drive the measured distance at your preselected gear and engine speed combination and record the time required to drive the distance in *seconds*. To improve precision, you may want to time two or more separate runs and take the average of two runs.

Table 1. Distance calibration table for sprayers

Nozzle or Row spacing (inches)	Distance to time for calibration (feet)	Nozzle or Row spacing (inches)	Distance to time for calibration (feet)
40	102	**26**	157
38	107	**24**	170
36	113	**22**	185
34	120	**20**	204
32	127	**18**	227
30	136	**16**	255
28	146	**14**	291

3. Park the sprayer and, using a measuring cup or bucket, catch the spray output from a single nozzle for the length of time it took you to drive the measured distance in step one. Be sure that the sprayer is running at the same engine speed and spray pressure. *Note*: For banding rigs where you used row spacing to determine the distance in step 1 and where more than one nozzle is

directed to the row, catch the output for all nozzles directed to a single row.

4. The total amount of water, measured in ounces, collected per nozzle or row in step 3 equals gallons per acre (GPA).

Determining how much herbicide product to add to the spray tank:

Now that you have successfully calibrated your sprayer, the next step is to determine how much chemical you need to add to the tank.

1. Divide the tank capacity by gallons per acre to get the number of acres a full tank can spray:

[Tank capacity (gallons)÷ GPA] = Number of acres covered by one full tank

2. Multiply the recommended pesticide rate from the label (pt/A, oz/A, lb/A, etc.) by the number of acres covered by a full tank (from step 1.)

3. **Note:** All pesticide rates in this handbook are given as *broadcast rates*. For *band applications*, you must adjust the rate using the following formula:

[Band Width × Broadcast Rate] ÷Row Width = Band Rate

Examples of calibration & how much to put in the tank.

Broadcast Application:

You plan to spray generic glyphosate herbicide, plus a nonionic surfactant for burn-down prior to planting cotton. Your sprayer has a uniform nozzle spacing of **18 inches.** You have thoroughly cleaned your sprayer and replaced all non-uniform nozzles (and yes there were some!)

1. From **Table 1**, note that the distance to drive is **227 feet**. Measure this distance in the field to be sprayed.
2. Set your throttle and drive the **227 feet** for several runs. Let's say that it took you an average of **39 seconds** to drive this distance.
3. Now, at the same engine speed and at your desired spray pressure, and with your sprayer standing still, catch the output in *ounces* for 39 seconds from any *one* nozzle, the average time it took your rig to travel the 227 feet. You catch 20 ounces during the 39 second time period. Therefore, your sprayer output is **20 GPA**.
4. After reading the generic glyphosate label and the weed control recommendations for cotton, you decide to spray glyphosate at **1 qt/A**, plus a nonionic surfactant at **1 qt/100 gallons** of spray mix. Let's assume you have a 500-gallon spray tank.

   How many acres will one tank load cover?

[500 gal tank÷ 20 GPA] = 25 acres covered by one tank load
So, 1 qt/A × 25 acres = **25 quarts** (~6.25 gallons) of glyphosate per tank load

What about the surfactant:

500 gal × (1 qt/100 gal) = **5 qts**. surfactant per spray tank load.

Band Application:

You plan to apply Staple herbicide plus nonionic surfactant in a **19 inch band** on **38 inch rows**. Your banding rig is set up with three nozzles directed to the band on each row.

Your sprayer has been thoroughly cleaned, and the nozzles are uniform in output, after replacing those out of range.

1. Using the chart again, the distance to travel for a **38 inch row** is **107 feet**. You measure your course drive it several times. Let's assume it took an average of 18 seconds.
2. Park the sprayer and at the same engine speed and your desired pressure, collect the output of each of the three nozzles for 18 seconds. If the *combined* total output of the three nozzle band cluster is, for example, 25 ounces, the sprayer is applying **25 gallons per acre**.
3. Now, let's say your sprayer has a **200 gallon tank**. The broadcast rate for Staple is **2.2 fl oz/A**, and **nonionic surfactant** is to be added at **1 qt/100 gal. of spray mix**.

[200 gal tank÷25 GPA] = 8 acres covered per tank

4. Now, reduce the rate for a 19 inch band:

[19 inch band÷ 38 inch broadcast] ×2.2 oz/A Staple product = 1.1 oz/A Staple

Therefore: 8 acres × **1.1 fl oz/A** = **8.8 fl oz Staple needed** per tank

Surfactant needed per tank is, 200 gallon tank × (1 qt surfactant/100 gallon spray). = **2 qts. nonionic surfactant** per tank

Note: the surfactant rate in this example is calculated based on *amount per volume of spray mix*, rather than amount per acre, it is calculated the same as for broadcast applications.

Post-Directed and Hood Applications:

You plan to use a hooded sprayer to make post-directed and hooded applications in your **38 inch row** cotton. Given, the gallon per acre (GPA) under the hood needs to match as close as possible to the GPA of your post-directed band. The hooded rig is set up to use **two nozzles** post-directing on a **13 inch band** and has **three nozzles** under the hood spraying **a 25 inch band**.

Scenario 1: One pump applying one tank mix.

1. The distance to travel for a **38 inch row** is **107 feet (Table 1)**. You measure your course and drive it. Let's assume it took an average of **18 seconds**.
2. Park the sprayer and at the same engine speed and at the desired pressure, and collect the output of the **three nozzles** under the hood for 18 seconds. Combine the output of the three nozzles and measure. The combined total, *for example **20 ounces*,** equals the application rate in GPA. In this case your hoods are applying at **20 GPA**.
3. Next, with your sprayer running at the same engine speed and pressure, collect the output of the **two post-directing nozzles**. Combine the output from these **two nozzles** and measure. The combined total, for *example **13 ounces***, equals the application rate in GPA. In this case the post directing nozzles are applying at **13 GPA**.
4. Remember, you want the application rate *to be the same for both the post-directed and hooded application.* To accomplish this, decide which application rate fits your particular needs. In this example we will assume that **13 GPA post-directed** is ideal. To get your hooded application to be **13 GPA**, instead of **20 GPA**, *reduce the size of the spray tips* under the hood and re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

Scenario 2. Two (2) pumps applying separate tank mixes.

1. From **Table 1**, the distance to travel for a **38 inch row** is **107 feet**. Your course is measured and you drive it. Let's assume it took **18 seconds**.

2. Park the sprayer and at the same engine speed and desired pressure, collect the output of the **three nozzles** under the hood for **18 seconds**. Combine the output of the three nozzles and measure. The combined total, for *example **18 ounces***, equals the application rate in GPA. In this case the hoods are applying at **18 GPA.**

3. Next, with the sprayer running at the same engine speed and desired pressure, collect the output of the **two post-directing nozzles**. Combine the output from these two nozzles and measure. The combined total, *for example **15 ounces***, equals the application rate in GPA. In this case the post directing nozzles are applying at **15 GPA**.
4. Remember, you want the *application rate to be the same for both the post-directed and hooded application*. To accomplish this, decide which application rate fits your particular needs. In this example we will assume that **15 GPA post-directed** is ideal. To get your hooded application to be 15 GPA instead of 18 GPA, you have two (2) options.

   a) First *reduce the pressure for the pump* applying under the hood. *Caution*: Be sure that after reducing the pressure the spray tip *still produces an acceptable spray pattern*. Repeat the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

   b) The second option is to *change to a smaller spray tip size under the hood* to reduce the application rate to 15 GPA. Repeat the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

SPRAY DRIFT MANAGEMENT

Mike Marshall, Extension Weed Specialist

- ✓ READ the PESICIDE LABEL for instructions on preventing drift!
- ✓ Use as coarse a spray pattern as possible.
- ✓ Use a solid cone or flat fan spray nozzle tip instead of a hollow cone tip.
- ✓ Use a low spray pressure. *Be sure your nozzles will maintain pattern at a lower pressure*.
- ✓ Don't apply pesticides under windy or gusty conditions. *Read your label for max speeds!*
- ✓ Use a hand-held anemometer to determine wind speed at the location and time of your applications.
- ✓ Determine wind direction.
- ✓ Don't spray when the wind is less than 3 mph to avoid spraying in thermal inversions.
- ✓ Maintain required buffer zones.
- ✓ Use an application method and formulation that is less likely to cause drift.
- ✓ Use drift control/drift reduction agents in your tank mix.
- ✓ *If possible*, don't spray when the temperature is above 90 – 95^{0}F.
- ✓ Know your surroundings, especially the location and distance of sensitive crops, sensitive sites.

*As an applicator, **YOU** are responsible for where the chemicals from your applications go!*

SPRAYER CLEANING

Mike Marshall, Extension Weed Specialist

Small amounts of pesticides left in sprayers can cause serious damage if applied to sensitive crops. For example, traces of growth regulator type herbicides used for pasture weed control,

including 2,4-D, Banvel, Weedmaster, Crossbow, etc., can create serious problems if accidently applied to sensitive broadleaf crops including tobacco, cotton, tomatoes and other sensitive plants. Most of these herbicides, particularly the ester formulations of 2,4-D and Crossbow, are difficult to thoroughly wash out of a sprayer. *Therefore, we recommend using a dedicated sprayer for application of pasture and brush control herbicides.*

The sulfonylureas and imidazolinones herbicides, including Accent, Classic, Exceed, Staple, and Scepter, have also created sprayer cleaning challenges. These herbicides have a high unit activity (a small amount of product that is left in the sprayer is very active on a per acre basis). Small amounts of these materials cause serious damage to non-target, susceptible crops. Other products, including Valor SX, have specific clean-out instructions outlined on the label and should be followed explicitly to prevent subsequent contamination of sensitive crops.

Your tank is only one part of the sprayer. You can do an excellent job of cleaning the tank, but if chemical residues are left in the hoses, strainers, and pump, serious crop damage can still occur. Pesticides can be absorbed into the lines, in addition to polyethylene or fiberglass tanks, where they can remain for a long time. Some dry flowable and wettable powder formulations build up on the bottoms of spray tanks, particularly in sprayers with inadequate agitation. *The longer a spray mix is left in the system, the greater is the potential contamination problem the next time you use the sprayer unit.* **Sprayers should be cleaned as soon as practical and herbicide spray mixtures should *never* be allowed to dry in the sprayer.**

Personal protective equipment that is recommeded on the pesticide label for that product should be worn during clean-up. *Do not clean sprayers near wells, sink holes, creeks or other surface water, or near desirable vegetation.*

Many herbicide labels have sprayer cleanup recommendations on the label. For example, Valor product label recommends a specific tank mix cleaner product (Valent tank cleaner) after each use of a flumioxazin containing product. Other products recommend adding household ammonia at 1 gallon of ammonia for each 100 gallons of water. Ammonia is also useful for removing 2,4-D ester residues left in the sprayer because ammonia changes the less soluble ester into a more highly water soluble ammonium salt of 2,4-D. Many commercial tank cleaners are available and most do a good job, if properly used, of cleaning a sprayer. They are just like ammonia in that plenty of water and proper procedure are required.

Sprayer cleaning procedure:

1. Drain the spray equipment. Thoroughly rinse the tank and flush hoses, boom and nozzles with clean water. Loosen and physically remove any visible deposits.

2. Fill the sprayer with clean water and add household ammonia (one gallon of a 3% active ammonia product for every 100 gallons of water). Flush the hoses, boom and nozzles. Shut-off the boom and then top-off the tank with water. Let the material circulate for at least 15 minutes, and then flush the hoses, boom and nozzles again. Drain the tank.

3. Remove screens, strainers, and tips; clean in a bucket of water.

4. Repeat step 2.

5. Thoroughly rinse the tank, hoses, boom and nozzles.

Important: *Remember to clean all other associated application equipment. Personal protective equipment, as prescribed on the label, should be worn during the clean-up process and do not clean sprayers near wells, sink holes, creeks or other surface water, or near desirable vegetation.*

HERBICIDE ADJUVANTS

Mike Marshall, Extension Weed Specialist

Spray Additives

A spray additive is any substance added to an herbicide tank mix to enhance performance. Adjuvants are classified on the basis of their use rather than chemistry. Adjuvants include surfactants, emulsifiers, wetting agents, stickers, de-foamers, compatibility agents, crop oils, and drift control agents.

Types of Spray Additives:

Surfactants (surface-active-agent): Are used to improve emulsifying, dispersing, spreading, wetting, or other surface modifying properties of a liquid. Three types of surfactants are emulsifiers, wetting agents, stickers. Choose a non-ionic surfactant based on composition. A surfactant with 80% or greater active ingredient is a good choice.

Emulsifiers: Substances that promote suspension of one liquid in another. They are most commonly used to disperse oil in water. These are usually contained in the herbicide package formulation.

Wetting agents: Reduce interfacial tensions between surfaces that would normally repel each other. These allow a spray solution to spread and adhere better to waxy cuticles of plants. Nonionic surfactants (NIS) are the type usually added to a spray tank. They are good dispersing agents, stable in cold water, and have low toxicity to plants and animals.

Stickers: Adjuvants that promote adherence of herbicides to the plant foliage. They reduce runoff potential during application and wash off by rainfall. These are usually blended with wetting agents to provide better coverage and are called spreader-stickers.

Antifoaming Agents: These materials reduce foam in a sprayer system so that pumps and nozzles can operate effectively.

Compatibility Agents: Aid in holding herbicides in solution when mixed with pesticides or fertilizers.

Crop Oils: These are non-phytotoxic light petroleum or vegetable oils that contain surfactants. Use much like a surfactant. Has a tendency to burn crop tissue. Choose crop oil which contains 80% or greater oil, and the rest as surfactants or emulsifiers.

Drift Control Agents: Materials used to reduce the number of fine particles in the spray pattern which could result in drift damage.

PESTICIDE SAFETY

Robert Bellinger, Safety Education Coordinator

Pesticide Storage Tips

Are you doing these?

- Store your pesticides in a detached structure?
- Have a storage building with a sound roof?
- Have a storage building with a sound, liquid-proof floor?
- Store your pesticides in their original container?
- Have pesticides you store with intact, readable labels?
- Store your pesticides separately from gasoline, other fuels and solvents?

Properly rinse procedure your empty pesticide containers!

The proper rinse procedure requires that you plan ahead!

- ✓ Read and follow label directions!
- ✓ Wear the required protective clothing and equipment.
- ✓ Rinse containers immediately after emptying because pesticides will dry or solidify quickly and become difficult to remove.
- ✓ Consider the volume of the rinsate when filling the sprayer tank. Leave enough room in the sprayer tank to accommodate the rinsate before filling the tank.
- ✓ Have back-flow protection when filling the sprayer tank and rinsing the container.

You have two acceptable ways to rinse empty pesticide containers:

1) Triple-rinsing or

2) Pressure-rinsing (jet-rinsing) using a device specifically manufactured to wash container interiors.

Triple-rinse container instructions:

- ✓ Allow empty pesticide container to drain into the sprayer tank for at least 30 seconds.
- ✓ Fill container one-quarter full of clean water or appropriate spray rinse diluent. Replace cap securely and roll, swirl and shake the contents vigorously for at least one full minute to rinse all surfaces!
- ✓ Remove container cap and empty rinsate into the spray tank. Allow the container to drain for at least 30 seconds.
- ✓ Repeat the fill, shake and drain procedure two (2) more times, using clean water.
- ✓ Properly dispose of the rinsed containers as soon as possible. Dispose of caps with the containers unless recycling.
- ✓ Plastic and plastic-lined bags can be triple-rinsed. For paper and fiber bags and similar containers, completely empty the contents into the tank. Open both ends of the container to remove any remaining pesticide and to prevent reuse.

How to pressure-rinse containers:

- ✓ Allow the empty pesticide container to drain into the sprayer tank for at least 30 seconds.
- ✓ Hold the container upside down over the sprayer tank opening so that rinsate will run into the sprayer tank. For ease and safety, puncture through the bottom of metal containers and through the side of plastic containers with appropriate tool or pressure-rinsing nozzle-follow specific manufacturer directions.
- ✓ Thoroughly rinse the empty container for the time interval recommended by the pressure-rinse nozzle manufacturer, but no less than 30 seconds, using at least 40 psi water pressure.
- ✓ Properly dispose of your rinsed containers as soon as possible. Dispose of caps with containers, unless recycling.

PESTICIDE RESISTANCE MANAGEMENT

Robert G. Bellinger, Extension Entomologist

Repeated use of pesticides – *herbicides, insecticides, fungicides, nematicides, rodenticides, and others* - can lead to resistance in the respective pest populations. Applicators are encouraged to rotate products with differing modes of action within a crop year. Many pesticide labels now give detailed guidance.

Resistance may be defined as “a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species”.

Resistance arises through the over-use and/or misuse of a pesticide against a pest species and results from the selection of resistant forms of the pest and the resulting evolution of pest populations that are resistant to that pesticide and its mode of action (MoA). Pesticides do NOT cause the mutations for resistance.

In the majority of cases, not only does resistance render the selecting compound much less effective but it often also confers cross-resistance to other chemically related compounds. Cross-resistance occurs when resistance to one pesticide confers resistance to another pesticide, even where the pest has *not* been exposed to the latter product.

The objective of successful Pesticide Resistance Management is to delay the evolution of pest resistance to pesticides, or to help regain susceptibility in pest populations in which resistance has already arisen.

Because many pest populations are usually large in size and quickly reproduce (especially mites, many insects and most plant pathogens), there is always a risk that pesticide resistance may evolve quickly, especially when pesticide are misused or over-used.

If you obtain less control of a pest with a given pesticide than you are accustomed to, or believe is reasonable to expect, *first* check to be sure that you applied the pesticide properly according to the label instructions. If you made your application properly, next consider if there were any extreme environmental conditions – very hot, very cool, heavy rain, etc. If none of these conditions existed, or are not believed to have an effect on the product's performance, then pesticide resistance is a possibility.

Doing everything you can to delay pesticide resistance is important for the obvious reasons. There is not very much new chemistry coming to allow us to switch to new pesticide modes of action. For instance, there have not been any significant new modes of action for herbicides in about three decades. While new herbicide products are coming onto the market, often in conjunction with herbicide resistant crop varieties, the herbicides themselves are some of the oldest herbicides we have, for instance 2,4-D.

There are several ways to delay pesticide resistance. The best is to use Integrated Pest Management (IPM) and to use economic injury thresholds to determine when to apply a pesticide(s). Other methods include rotating crops to prevent buildup of the same pest populations over time, to use the lowest effective rate or rate recommended by the pesticide label or a knowledgeable expert, and make spot or perimeter applications on small or defined pest populations. When using pesticides, rotate pesticide modes of action by rotating pesticide chemical families.

For most growers, however, knowing what pesticides to use to do this has been difficult because of a lack of knowledge of the many different modes of action. Until recently pesticide labels did not provide much information to assist in these decisions.

To help growers and others combat pesticide resistance a number of national and international resistance action committees have been formed by the pesticide industry and others to address the problem of pesticide resistance. These committees are based on the different major pesticide groups. So, for herbicides there is an Herbicide Resistance Action Committee (HRAC), an Insecticide Resistance Action Committee (IRAC) for insecticides, a Fungicide Resistance Action Committee (FRAC) for fungicides, and so on. These committees have studied the modes of action of the respective pesticide families and developed a system to help growers and others

better select pesticides from different pesticide chemical families to allow users to effectively rotate the modes of action and thus combat pesticide resistance in their pests. This information is now appearing on pesticide labels. In addition to the system developed by the respective Action Resistance Committees, many pesticide manufacturers are beginning to supply information on resistance management on their labels in sections titled "Resistance Management".
To date, generic pesticide products tend not to have as much information as brand name pesticide products.

When you want to rotate modes of action against your pests, first make sure that whatever pesticide you select is labeled for your intended use. Next, look for a pesticide group number on the label, or a statement indicating the pesticide group. Using these pesticide group numbers, you do not have to know or understand the complex modes of action of these chemicals, you just have to select a product(s) with a *different* group number that is labeled for your pest management need. Examples of group numbers when they appear on pesticide labels are usually in the upper right hand corner of the label, look like this:

GROUP	**4A**	**INSECTICIDE**

GROUP	**3**	**HERBICIDE**

GROUP	**11**	**FUNGICIDE**

PESTICIDE APPLICATION RECORDKEEPING

Robert Bellinger, Pesticide Safety Coordinator

Certified Private Applicators are required to keep records of their applications of Restricted Use Pesticides (RUPs). This federal requirement is administered by the USDA and in South Carolina is enforced by the Department of Pesticide Regulation.
The information – "data elements" – required to be kept are actually minimal. Private Applicators will likely want to record more information on their applications, all of their applications, to help with their present and future pest management efforts. Good records help you trouble-shoot application problems and duplicate pest management successes.

The data elements required to be kept on each RUP application are:

- ☐ The brand/product/trade name of the pesticide
- ☐ EPA product Registration Number
- ☐ Total amount of pesticide *product* applied
- ☐ Size of area or the number of units treated
- ☐ Crop or Site applied to
- ☐ *Actual* location of the application
- ☐ Date of application: Month, Day, Year
- ☐ Certified applicator name and license number

Records must be made within 14 days of each application of an RUP. Records must be maintained for a minimum of two (2) years from the date of the application.

Spot treatments: Spot applications are small applications which total less than 1/10th of an acre, and they are made in the same day. Spot

applications do *not* apply to nurseries or greenhouses.

For Spot treatments you must record:
☐ Date of application - month, day, year
☐ Brand or product name
☐ EPA Registration Number
☐ Total amount of pesticide applied
☐ Location of the pesticide application, designated as "spot application" with a short description.

Record keeping tips:
Record all three (3) identifiers for your RUP. *They're all on the label!*
- The **Product** or **Brand (Trade) name**
- The **Common Chemical name** of the **active ingredients**
- **The EPA Registration No.**

Keep additional information that will help YOU better achieve YOUR pest and pesticide management objectives. For instance, amount of water used, spray pump pressure, boom height, nozzle spacing tip used, tractor speed or rpms, other equipment settings, and weather information such as temperature, rainfall the 24 hours before and 24 hours after the application, wind speed (recorded at the site of the application at the time of the application), notes on any application problems, and any other information that would be useful to *you*.

You are required to keep records of any worker or handler pesticide safety training you conduct or have conducted for your ag employees.

HONEY BEE STEWARDSHIP

Jennifer Tsuruda, Extension Apiculturist

Honey bees are our most beneficial insect. The estimated value of honey bee pollination in the US is $14 billion. Many commercially grown crops in South Carolina are heavily dependent on honey bees for good pollination. Annual farm cash receipts of crops harvested in South Carolina that are dependent on honey bees for pollination are estimated at $25 million. This does not include home-grown vegetables and fruits and plants for wildlife that are highly dependent on bees for pollination. Some of the fruits and vegetables that are highly dependent on bees for pollination are apples, cantaloupes, cucumbers, squash, strawberries, and watermelon.

Use integrated pest management recommendations whenever possible to minimize harmful effects to our beneficial insects. Many pesticides are extremely toxic to bees. Those pesticides that are toxic or highly toxic to bees will have a bee protection warning statement on the label. The pesticide applicator should always review the product label directions carefully before each use and follow the guidelines to protect our pollinators, which include native bees as well as honey bees. Keep in mind that even herbicides and fungicides can have negative effects on insect pollinators and can have synergistic effects when combined with other pesticides.

It is not only the formulation of the chemical pesticide that is important, applicators must also be aware of the proper dose. Pesticides should be used only when necessary, especially if flowering plants are present or nearby and are attractive to bees. Select the least toxic pesticide to get the job done when possible and use the least hazardous method of application. Granular pesticide formulations are safest. Directed sprays applied with ground equipment are the next safest method for applying pesticides to protect bees. Aerially applied dusts or sprays are the most likely to contact bees and cause problems. Apply pesticides when the air is calm to reduce drift into areas where bees may be foraging or nesting. If a pesticide application is necessary,

apply in the evening when bees are not present. If managed bee colonies are present, it is best to give the beekeeper plenty of notice (3-4 days if possible) of your intentions. The beekeeper has the option to relocate their beehives if adjacent fields are to be sprayed. If there are many beehives or hives that cannot be moved on short notice, the beekeeper may cover their beehives with wet burlap for no longer than 2 days. It will be necessary for the beekeeper to spray covered hives with water and keep the burlap wet, especially in hot weather.

Beekeepers are advised to cooperate with growers in the area to help protect bees and are encouraged to have a contract with the landowner. Beekeepers should scout the area before bee colony placement to gain a good understanding of local farming practices, especially the use of highly toxic pesticides. Beekeepers are ill advised to place their colonies in high pest density areas, as they may require multiple pesticide applications. An example is cotton growing areas where various pests are expected. Beekeepers should post their name and contact information in the apiary or on colonies for identification purposes. Information on the relative toxicities of insecticides and miticides (used in specific crops) to honey bees and natural enemies may be found at www.ipm.ucdavis.edu.

Mosquito abatement programs should take into consideration the protection of our insect pollinators. Many of the pesticides used to kill mosquitoes will also kill honey bees. Beekeepers are urged to contact county officials who manage mosquito abatement programs to inform them of the location of their apiaries, so their honey bees can be protected.

Clemson University has started a bee stewardship program to facilitate communication between beekeepers and pesticide applicators and prevent accidental poisoning of honey bees. Beekeepers can map their hive locations and licensed pesticide applicators can access this information when they have an application planned. The applicator can then contact the beekeepers in the area or avoid applying pesticides near the hives. Interested individuals from both sides of this issue are encouraged to read more about the program on the Clemson University Beekeeping website and can sign up for the program there as well.

RELATIVE HONEYBEE SENSITIVITY TOWARD PESTICIDES

Jennifer Tsuruda, Extension Apiculturist

PESTICIDE TOXICITY TOWARD HONEYBEES

Group I Highly Toxic: *Severe bee losses are expected if the following pesticides are applied to flowering crops or weeds which are attractive to bees or when these pesticides are applied near a beehive. These pesticides will remain hazardous to foraging bees for up to 24 hours or longer after application.*		
abamectin (Agri-Mek, Zephyr)	acephate (Orthene, Address)	aminocarb (Matacil)
arsenicals	avemectin (AVID)	azinphosmethyl (Guthion)
bendiocarb (Ficam)	benzene hexachloride (BHC)	bifenthrin (Brigade, Capture)
bifenazate (Acramite)	bonyl (Swat)	calcium arsenate
carbaryl (Sevin, Sevin 80 S, Sevin XLR-Plus)	carbofuran (Furadan)	carbosulfan (Vantage)
chlordane	chlorpyrifos (Dursban, Eradex, Lorsban)	chlorethoxyfos (Fortress)
clofentezine (Apollo)	clothianidin (Poncho 600)	crotoxyphos (Cyodrin)
cyfluthrin (Baythroid)	cyhalothrin (Karate, Warrior)	cypermethrin (Ammo, Cymbush)
d-phenothrin (Sumithrin)	decamethrin (Decis)	deltamethrin (Decis)
diazinon (Diazinon, Spectracide)	dichlorvos (DDVP, Vapona)	dicrotophos (Bidrin)
dimethoate (Cygon, Dimethoate,	Rebelate)	emamectin (Proclaim)
endosulfan (Thiodan)	EPN	esfenvalerate (Asana)
ethyl parathion (Parathion)	famoxadone (Famoxate)	famphur (Famphos)
fenitrothion (Sumithion))	fenpropathrin (Danitol, Dasanit)	fensulfothion (Dasanit)
fenthion (Baytex)	fenvalerate (Ectrin, Pydrin)	fipronil
flucythrinate (Pay Off)	famoxadone (Famoxate)	formetanate (Carzol)
gamma-cyhalothrin, (Proaxis)	heptachlor	hexythiazox (Savey)
imidacloprid (Admire, Provado)	imidan	indoxacarb (Avaunt, Steward)
lambda-cyhalothrin (Commodore, Warrior)	lead arsenate	lindane (BHC)
LPOS (Sulfotine, RAID TVK)	malathion (Cythion, ULV)	methamidophos (Monitor, Tameron)
methidathion (Supracide)	methiocarb (Mesurol)	methomyl (Lannate, Nudrin)
methprene	methyl parathion (Penncap-M)	methyl parathion EC
mevinphos (Phosdrin)	mexacarbate (Zectran)	monocrotophos (Azodrin)
naled (Dibrom)2	omethoate (Folimat)	oxamyl (Vydate >1 lb/A)
parathion	phenthoate (Cidial)	phenamiphos (Nemacur P)
permethrin (Ambush, Gard Star, Pounce)	phorate (Thimet EC)	phosdrin
phosmet (Imidan)	phosphamidon (Dimecron)	polymer-encapsulated methyl parathion (Penncap-M)
prallethrin (ETOH)	proparite (Omite)	propoxur (Baygon)
pyridaben (Pyramite)	pyrazophos (Afugan)	resmethrin (Synthrin, SPB-1382)
spinosid (XDE-105, Tracer)	tebufenozide (Confirm)	TEPP2
tetrachlorvinphos (Appex, Gardona)	thiamethoxam (Actara, Platinum)	tralomethrin (Scout)
zeta-cypermethrin (Fury, Mustang)		

PESTICIDE TOXICITY TOWARD HONEYBEES (cont)

Group II Moderately Hazardous: *These can be used around bees if dosage, timing, and method of application are correct, but should not be applied directly on bees in the field or directed at the hive.*		
aldicarb (Temik)	aspon (ASP-51)	aldicarb sulfoxide
acetamiprid (Assail)	aluminum phosphide (Phostoxin)	*Bacillus thuringiensis* (Di-Beta)
bifenazate (Floramite)	binapacryl	biothion
carbaryl (Sevin XLR formulation, Sevinmol)	carbanolate (Banol)	carbophenothion (Trithion)
chlorfeninphos (Sopona)	coumaphos (Agridip, Asunthol, Co-Ral)	crotoxyphos (Ciodrin)
cypermethrin (Ammo)	cyromazine (Trigard)	DDT
deltamethrin (Decis)	demeton (Systox)	demeton-s-methyl (Metasystox)
diatomaceous earth (Diatect)	disulfoton (Di-Syston)	dichlofenthion
dioxathion (Delnav)	DSMA	emamectin benzoate (Proclaim)
endosulfan (Thiodan <0.5 lb/A, Thionex)	endrin	ethion (Ethodan)
ethoprop (Mocap)	ethyulan (Perthane)	fluvalinate (Mavrik)
fonofos (Dyfonate)	formetanate (Carzol)	fundal (Galecron)
malathion (Cythion, ULV <3 fl	oz/A)	methyl demeton (Metasystox)
mirex	MSMA	neem (Azatin, Neemix)
oil sprays (superior type)	oxamyl (Vydate <0.5 lb/A)	oxydemeton-methyl (Metasystox R)
paraquat	perthane	phorate (Thimet)
phosalone (Zolone)	pirimicarb (Pirimor)	profenfox (Curacron)
propamocarb (Carbamult)	propamocarb hydrochloride (Banol)	pymetrozine (Fulfill)
Pyramat	pyrethrum	pyriproxyfen (Esteem)
RDE (Rhonthane)	ronnel (Co-Ral, Korlan)	sabadilla
spinosad (SpinTor, Conserve SC, Entrust)	sulprofos (Bolstar)	stirofos (Rabon)
sumithrin (Anvillollo)	summer oil	tartar emetic
TDE	temephos (Abate)	terbufos (Counter)
trichlronate (Agritox)	thiacloprid (Calypso, YRC-2894)	thiamethoxam (Actara, Platinum)
thiazopyr (Mandate, Visor)	thiodicarb (Larvin)	trichoronate (Agritox)
zephyr		

PESTICIDE TOXICITY TOWARD HONEYBEES (cont)

Group III Relatively Nonhazardous: *These can be used around bees with a minimum risk of injury.*		
	allethrin (Pynamin)	amitraz (Mitac)
amitrole	avermectin (Agr-Mek)	azadirachtin (Align)
azoxystrobin (Abound)	*Bacillus thuringiensis* (Biobit)	DiPel, Full-Bac, Javelin, MVP)
Baculovirus heliothis	*Beauveria* (Mycotrol)	benomyl (Benlate)
binapacryl (Morocide)	bordeaux mixture	bromopropylate (Acarol)
bromoxynil	capsaicin (Hot Pepper Wax)	captan
carbaryl (Sevin G, Bait G)	carbofuran (Furadan G)	chloramben
chlorbenzide (Mitox)	chlorobenzilate (Acaraben)	chlordimeform (Fundal)
chlorobenzilate (Acaraben)	chlorothalonil (Bravo)	copper compounds (Kocide)
copper oxychloride sulphate	copper 8-quinolinolate	copper sulfate (Monohydrated)
cryolite (Cryolite, Kryocide)	cyromazine (Trigard)	dalapon
dazomet (Mylone)	demeton (Systox)	dexon
diazinon (Diazinon G)	dicamba (Banvel D)	dichlone (Phygon)
dicofol (Kelthane)	difolatan	diflubenzuron (Dimilin)
dimite (DMC)	dinobuton (Dessin)	dinocap (Karathane)
diquat	disulfoton (Di-Syston G)	dodine (Cyprex)
dyrene	endothall	EPTC (Eptam)
ethephon (Ethrel)	ethion (Ethion)	ethoprop (Mocap G)
fenbutatin-oxide (Vendex)	fenhexamid (Elevate)	fenson (Murvesco)
ferbam	fluvalinate (Mavrik, Spur)	folpet (Phaltan)
garlic barrier	genite 923	glyodin (Glyoxide)
heliothis polyhedrosis virus	hexythiazox (Savey)	kaolin (Surround)
karathane (Dinocap)	kepone	malathion (Malathion G)
menazon (Saphos)	mancozeb (Dithane M-45)	maneb (Dithane M-22)
MCPA	menazon (Saphos)	metaldehyde (Metaldehyde Bait)
methoprene (Altosid)	methoxychlor (Marlate)	metiram (Polyram) - F1
monuron (Telvar)	myclobutanil (Rally)	nabam (Parzate)
nemagon	neotran	nicotine
nicotine sulfate	ovex	oxythioquinox (Morestan)
pentac	propargite (Omite)	pyrethrum (natural)
pyrimidinamine (Vangard)	pyriproxyfen (Esteen)	rotenone (Rotenone)
ryania (Rynodine)	sabadilla	silvex
simazine (Princep)	soap (M-Pede)	sulfur
tebufenozide (Confirm)	TDE (Rhothane)	tetradifon (Tedion)
tetram	thioquinox (Eradex)	thiram (Arasan)
toxaphene	trichlorfon (Dylox)	trifloxystrobin (Flint)
vendex	zineb (Dithane)	ziram
2,4-D	2,4-DB	2,4,5-T

[1]Fungicides

[2]Mevinphos (Phosdrin*), Naled (Dibrom*), and TEPP have short residual activity and kill only the bees contacted at time of treatment or shortly thereafter. They are usually safe to use when bees are not in flight; they are not safe to use around colonies.

[3]Not all strains of *Bacillus thuringiensis* insecticides are safe for bees. The label for XenTari® (Valent BioSciences), with active ingredient *B. thuringiensis aizawai*, reads "This product is highly toxic to honey bees exposed to direct treatment. Do not apply this product while bees are actively visiting the treatment area."

[4]List or information derived in part from Delaplane, K., University of Georgia, Tarpy, D., North Carolina State University, Fell, R., Virginia Tech, Johansen, C.A. and Mayer, D.F. Pollination Protection. 1990, Wicwas Press; Bulletin E-53-W, Hunt, G.J., Purdue University; Environmental Entomology 33(5):1151-1154.

MODE OF ACTION FOR HERBICIDES

Mike Marshall, Extension Weed Specialist

MODE OF ACTION (MOA) FOR HERBICIDES

Site of Action Group	MOA	Chemical Family (ies)	How it kills the plant	Product Examples
1	ACCase Inhibitors	Arloxyphenoxy propionate (FOPS)	Blocks the first step in fatty acid synthesis in grasses, broadleaves are naturally resistant to the fops and dims due to an insensitive ACCase enzyme.	FOPS: Assure II, Fusilade DX
		Cyclohexanedione (DIMS)		DIMS: Select MAX, Poast Plus
2	ALS Inhibitors	Sulfonylurea (SU)	Blocks the production of branched chain amino acids (isoleucine, leucine, and valine) in the plant. Plant death occurs due to insufficient branched chain amino acid levels at the growing points.	SU: Accent, Classic, Beacon
		Imidazonlinone (IMI)		IMI: Cadre, Raptor, Scepter
		Pyrimidines (PM)		PM: Staple
3	Microtubule Protein Inhibitor	Dinitroaniline (DNA)	Interferes with the alignment of the spindle apparatus during mitosis and prevents normal cell division in root tissue.	DNA: Prowl, Treflan, Sonolan
4	Synthetic Auxins	Phenoxy (PX)	Synthetic auxins mimic the natural plant hormone IAA. These herbicides affect cell wall plasticity and nucleic acid metabolism which leads to inhibited cell division and growth in the meristem regions (growing points).	PX: 2,4-D, 2,4-DB
		Benzoic Acid (BA)		BA: Clarity, Banvel, Status
		Carboxylic Acid (CA)		CA: Stinger, Milestone
5	Photosystem II Inhibitor	Triazine (TZ)	PS II herbicides inhibit photosynthesis by binding to the Q_B-binding site on the D1 protein of the photosystem II complex in the chloroplast. It blocks electron flow from Q_A to Q_B and stops CO_2 fixation and production of ATP and $NADPH_2$ which is the energy needed for plant growth and development. Plant death occurs due to excess free radicals destroying cell membranes.	TZ: Atrazine, Simazine, Caparol
		Triazinone (TN)		TN: Sencor
6		Nitriles (NT)		NT: Buctril
		Benzothiadiazinones (BZ)		BZ: Basagran
7		Ureas (UR)		UR: Lorox, Direx, Cotoran
8	Fatty Acid/Lipid Biosynthesis Inhibitor	Thiocarbamate (TB)	Most susceptible plants fail to emerge from the soil. Germination is not inhibited but growth of grass coleoptiles/broadleaf epicotyls ceases below soil surface	TB: Tillam
9	EPSP Synthase Inhibitor	Glycines (GC)	Glycines inhibit EPSP synthase enzyme which leads to the depletion of the aromatic amino acids tryptophan, tyrosine, and phenylalanine.	GC: Glyphosate

MODE OF ACTION (MOA) FOR HERBICIDE FAMILIES (cont)

Site of Action Group	MOA	Chemical Family (ies)	How it kills the plant	Product Examples
10	Glutamine Synthesis Inhibitor	Phosphinic Acids (PA)	Phosphinic acids inhibit the activity of glutamine synthetase which converts glutamate and ammonia to glutamine. Accumulation of ammonia to lethal levels destroys plant cells and tissue.	PA: Liberty
12	Phytoene Desaturase Inhibitor	Pyridazinone (PZ)	Pyridazinone inhibits the phytoene desaturase enzyme in the carteniod biosynthesis pathway Isoxazolidinone inhibits the 1-deoxy-D-xyulose 5-phosphate synthase (DOXP), a key component in the plastid isoprenoid biosynthesis pathway. Pyrazole and triketones inhibit the 4-hydroxyphenyl-pyruvate dioxygenase (4-HPPD) which affects carotenoid biosynthesis. These herbicide families deplete the carotenoid (accessory pigments in photosynthesis) pool that protects chlorophyll in the plant which results in a characteristic bleaching (white) of the plant tissue.	PZ: Solicam, Zorial, Brake
13	DOXP synthase Inhibitor	Isoxazolidinone (IA)		IA: Command
28	HPPD inhibitor	Pyrazole (PA)		PA: Balance, Corvus
		Triketone (TE)		TE: Callisto, Impact, Laudis
14	PPO inhibitors	Diphenylether (DE)	These herbicides inhibit the photoporphyrinogen oxidase (PPO), an enzyme that is responsible for chlorophyll and heme biosynthesis. PPO inhibition leads to accumulation of PPIX (protoporphyrin IX) which creates free radical oxygen in the cell and destroys cell membranes.	DE: Flexstar, Reflex, Blazer, Cobra
		N-phenylphthalimide (NP)		NP: Resource, Valor
		Ary triazinone (AT)		AT: Spartan, Aim, Cadet
15	VLFA inhibitors	Chloroacetamide (CA)	Acetamides are herbicides that inhibit very long chain fatty acid synthesis (VLFA) in shoot tissue during germination of sensitive plants.	CA: Dual Magnum, Intrro, Warrant, Outlook, Parrlay, Zidua
22	Photosystem I Inhibitor	Bipyridyliums (BP)	Bipyridyliums are herbicides that capture electrons from photosystem I complex in the chloroplast and are reduced to form herbicide free radicals. These free radicals destroy cell membranes.	BP: Gramoxone, Reward

CROP REPLANT GUIDELINES FOLLOWING HERBICIDE APPLICATION

Mike Marshall, Extension Weed Specialist

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
M = months, D = days, Spring = The spring following application, --- = no information								
Aatrex	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Acuron	0 D	10 M	10 M	10 M	10 M	18 M	18 M	4 M
Accent/Q	0 D	10 M	10 M	10 M	15 D	10 M	10 M	4 M
Achieve	30 D	106 D	30 D	106 D	106 D	106 D	106 D	30 D
Aim	0 D	0 D	0 D	0 D	0 D	0 D	12 M	0 D
Anthem	0 D	4 M	18 M	4 M	0 D	4 M	18 M	4 M
Anthem ATZ	0 D	Spring	Spring	Spring	Spring	Spring	Spring	Spring
Armezon	0 D	9 M	9 M	9 M	9 M	9 M	18 M	3 M
Assure II	120 D	0 D	120 D	120 D	0 D	0 D	120 D	120 D
Authority MTZ	10/4[1] M	12 M	18/12[2] M	12 M	0 D	12 M	12 M	4 M
Axial XL	90 D	90 D	90 D	90 D	90 D	90 D	90 D	0 D
Axiom	0 D	8 M	12 M	12 M	0 D	12 M	12 M	7 D/4 M[3]
Balance Flexx	0 D	10 M	6 M	11 M	6 M	6 M	18 M	4 M
Banvel/Clarity	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D
Basagran	---	---	---	---	---	---	---	---
Beacon	14 D	8 M	8 M	8 M	8 M	8 M	8 M	3 M
Beyond	0 D[4]/8.5 M[5]	9 M	9 M	9 M	0 D	0 D[4]/9 M[5]	9 M	0 D[4]/3 M[5]
Bicep II Magnum	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Boundary	4 M	8 M	12 M	12 M	12 M	12 M	12 M	4.5 M
Breakfree	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Breakfree ATZ	0 D	Spring	Spring	15 M	Spring	15 M	15 M	15 M
Buctril	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D
Bullet/Lariat	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Cadet	0 D	Spring	Spring	Spring	0 D	Spring	Spring	Spring
Cadre	9 M	18 M	18 M	0 D	9 M	26 M	9 M	4 M
Callisto	0 D	10 M	0 D	10 M	10 M	10 M	10 M	120 D
Canopy	10 M	10 M	10 M	8 M	0 D	18 M	10 M	4 M
Caparol	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring
Capreno	0 D	10 M	10 M	11 M	10 M	18 M	12 M	4 M
Cinch	0 D	0 D	0 D	0 D	0 D	0 D	Spring	4.5 M
Cinch ATZ	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Clarity								
8 fl oz/A	0 D	21 D	15 D	120 D	14 D	120 D	120 D	15 D
16 fl oz/A	0 D	120 D	120 D	120 D	28 D	120 D	120 D	30 D
24 fl oz/A	120 D	120 D	120 D	120 D	120 D	120 D	120 D	45 D
25-64 fl oz/A	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D
Classic	8 M	7 M	9 M	6 M	0 D	18 M	9 M	3 M
Cobra	None	None	None	None	None	None	None	None
Command	9 M	0 D	9 M	9 M	0 D	12 M	0 D	12 M
Corvus	0 D	10 M	17 M	11 M	9 M	17 M	17 M	4 M
Cotoran 4L	8 M	0 D	9 M	8 M	9 M	12 M	12 M	3 M
Crusher	0 D	1 M	10 M	1.5 M	1 M	10 M	10 M	3 M
Dawn	10 M	0 D	18 M	10 M	0 D	18 M	18 M	4 M

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
M = months, D = days, Spring = The spring following application, --- = no information								
Define	0 D	4 M	12 M	12 M	0 D	12 M	12 M	12 M
Degree	0 D	Spring	0 D	Spring	0 D	Spring	0 D	Spring
Degree Xtra	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Devrinol	12 M	12 M	12 M	12 M	12 M	12 M	0 D	180 D
Direx/Diuron								
USE PATTERN 1[6]	4 M	4 M	4 M	4 M	4 M	4 M	4 M	4 M
USE PATTERN 2[7]	Spring	Spring	Spring	12 M	12 M	12 M	12 M	12 M
LAYBY	Spring	Spring	Spring	12 M	12 M	12 M	12 M	12 M
Distinct	30 D	30 D	30 D	120 D	30 D	120 D	120 D	30 D
Dual 8E	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Dual Magnum	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Dual II Magnum	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Envive	8 M	10 M	12 M	8 M	0 D	18 M	10 M	4 M
Envoke	7 M	7 M	7 M	7 M	7 M	18 M	7 M	3 M
ET/ETX	0 D	0 D	30 D	30 D	0 D	30 D	30 D	0 D
Evik	11 M	11 M	11 M	11 M	11 M	11 M	11 M	3 M
Expert	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Express	14 D	14 D	14 D	45 D	14 D	45 D	45 D	0 D
Fierce								
3.0 oz/A	7 D[8]/1 M[9]	45 D[9]/30 D[8]	18 M	4 M	0 D	4 M	18 M	30 D
3.75 oz/A	30 D	2 M	18 M	4 M	0 D	4 M	18 M	2 M
Finesse	14 M	Spring[10]	Spring[10]	Spring[10]	6 M[11]	Spring[10]	Spring[10]	4 M
Firestorm	0 D	0 D	0 D	0 D	0 D	0 D	0 D	0 D
FirstRate	9 M	9 M	9 M	9 M	0 D	30 M	18 M	4 M
FirstShot	14 D	14 D	14 D	45 D	7 D	45 D	45 D	0 D
Flexstar	10 M	0 D	10 M	10 M	0 D	18 M	18 M	4 M
Flexstar GT/GT 3.5	10 M	0 D	10 M	10 M	0 D	18 M	18 M	4 M
FulTime NXT	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Fusilade DX	60 D	0 D	60 D	0 D	0 D	0 D	0 D	60 D
Fusion	60 D	0 D	60 D	0 D	0 D	0 D	0 D	60 D
Gangster	9 M	9 M	9 M	9 M	0 D	30 M	30 M	3 M
Glyphosate	0 D	0 D	0 D	0 D	0 D	0 D	1 M	0 D
Goal/GoalTender	10 M	7 D	10 M	60 D	7 D	60 D	60 D	10 M
Gramoxone SL	0 D	0 D	0 D	0 D	0 D	0 D	0 D	0 D
Guardsman Max	0 D	Spring	0 D	Spring	Spring	Spring	24 M	Spring
Halex GT	0 D	10 M	0 D	10 M	10 M	10 M	10 M	120 D
Harnass	0 D	7 D	45 D	45 D	0 D	45 D	45 D	7 D
Harmony Extra	21 D	21 D	21 D	45 D	14 D	45 D	45 D	0 D
Harmony GT/XP	0 D	7 D	0 D	45 D	0 D	45 D	45 D	0 D
Harness	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Harness Xtra	Spring	Spring	Spring	Spring	Spring	24 M	24 M	Spring
Hornet WDG	0 D	18 M	12 M	18 M	10.5 M	18 M	18 M	4 M
Huskie	9 M	Spring[10]	4 M	Spring	4 M	9 M	Spring[10]	1 M
Impact	0 D	9 M	9 M	9 M	9 M	9 M	18 M	3 M
Instigate	0 D	10 M	10 M	18 M	10 M	10 M	18 M	4 M
Interline	0 D	0 D	180 D	180 D	0 D	180 D	180 D	70 D
Intrro	---	---	---	---	---	---	---	---
Keystone NXT	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Laudis	0 D	10 M	10 M	18 M	8 M	18 M	18 M	4 M

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
M = months, D = days, Spring = The spring following application, --- = no information								
Layby Pro[12]								
0-0.6 lb ai	4 M	4 M	4 M	4 M	4 M	4 M	4 M	3 M
0.61-1.0 lb ai	4 M	4 M	4 M	8 M	8 M	12 M	8 M	4 M
1.01-1.6 lb ai	4 M	4 M	4 M	12 M	8 M	12 M	8 M	8 M
1.61-2.2 lb ai	8 M	8 M	8 M	12 M	12 M	12 M	12 M	12 M
Leadoff	0 D	1 M	10 M	10 M	1 M	10 M	10 M	3 M
Liberty 280 SL	0 D	0 D	180 D	180 D	0 D	180 D	180 D	70 D
Linex/Lorox	0 D	0 D	0 D	4 M	0 D	4 M	4 M	4 M
Lumax	0 D	Spring	Spring	Spring	Spring	18 M	18 M	4.5 M
Marksman	0 D	Spring	0 D	Spring	Spring	Spring	24 M	10 M
MCPA	None	None	None	None	None	None	None	None
Micro-Tech	None	None	None	None	None	None	None	None
MSMA	None	None	None	None	None	None	None	None
NIC-IT	0 D	10 M	18 M	18 M	15 D	10 M	18 M	8 M
Nimble	21 D	21 D	21 D	45 D	14 D	45 D	45 D	0 D
Optill	8.5 M	18 M	18 M	4 M	0-1 M[13]	18 M	9.5 M	4 M
Option	7 D	60 D	60 D	60 D	14 D	60 D	60 D	60 D
Osprey	12 M	90 D	10 M	90 D	90 D	30 D	10 M	7 D
Outlook	0 D	Spring	Spring	0 D	0 D	Spring	Spring	4 M
Parallel PCS	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Parazone	0 D	0 D	0 D	0 D	0 D	0 D	0 D	0 D
Peak	1 M	10 M	1 M	10 M	10 M	22 M	18 M	0 D
Poast/Poast Plus	30 D	0 D	30 D	0 D	0 D	30 D	0 D	30 D
PowerFlex/HL	9 M	9 M	9 M	9 M	5 M	9 M	12 M	30 D
Prefix	10 M	1 M	18 M	10 M	0 M	18 M	18 M	4.5 M
Prowl/Prowl H_2O	Spring	0 D	10 M	0 D	0 D	0 D	0 D	4 M
Pursuit	8.5 M	18 M	18 M	0 D	0 D	18 M	9.5 M	4 M
Python	0 D	18 M	12 M	4 M	0 D	18 M	9 M	4 M
Raptor	8.5 M	9 M	9 M	9 M	0 D	9 M	9 M	3 M
Quelex	3 M	3 M	3 M	9 M	3 M	3 M	15 M	0 D
Reflex	10 M	0 D	10 M	10 M	0 D	18 M	18 M	4 M
Realm Q	0 D	10 M	10 M	10 M	10 M	10 M	10 M	4 M
Report Extra	18[14] M	18 M	18[14]/4[15] M	---	6[16]/18[14] M	---	---	0[17]/4[18] M
Resicore	0 D	18 M	10.5 M	18 M	10.5 M	18 M	18 M	4 M
Resolve DF								
1.0 oz/A	0 D	10 M	10 M	18 M	10 M	10 M	18 M	3 M
2.0 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	3 M
Resolve Q/Q (mp)								
1.25 oz/A	0 D	1 M	10 M	10 M	10 M	10 M	10 M	3 M
2.5 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	3 M
Resolve SG								
1.0 oz/A	0 D	1 M	10 M	18 M	10 M	10 M	18 M	4 M
2.0 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	4 M
Resource	0 D	30 D	30 D	30 D	0 D	30 D	30 D	30 D
Revulin Q	0 D	10 M	10 M	10 M	10 M	10 M	10 M	4 M
Rhythm	8 M	0 D	18 M	10 M	0 D	18 M	18 M	4 M
Sandea	1 M	4 M	2 M	6 M	9 M	18 M	36 M	2 M

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
M = months, D = days, Spring = The spring following application, --- = no information								
Scepter	9.5 M	18 M	11 M	11 M	0 D	18 M	9.5 M	3 M
Sentrallas	0 D	120 D	0 D	120 D	120 D	120 D	120 D	0 D
Select/Select MAX	None	None	None	None	None	None	None	None
Sequence	0 D	0 D	0 D	0 D	0 D	Spring	Spring	4.5 M
Sharpen								
1.0 oz/A	0 D	1.5 M	0 D	4 M	0-1M[19]	4 M	4 M	0 D
2.0 oz/A	0 D	3 M	0 D	5 M	1-2 M[19]	5 M	5 M	0 D
3.0 oz/A	0 D	4 M	0 D	6 M	2-3 M[19]	6 M	6 M	0 D
Solida								
1.0 oz/A	0 D	1 M	10 M	18 M	1 M	10 M	18 M	3 M
2.0 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	4 M
Sonalan	Spring	Spring	Spring	0 D	0 D	0 D	Spring	Spring
Sonic	10 M	12-18 M[20]	12 M	12 M	0 D	30 M	30 M	4 M
Spartan	10 M	12 M	10 M	12 D	0 D	0 D	0 D	4 M
Spartan Charge	4 M	12 M	10 M	4 M	0 D	0 D	0 D	4 M
Stanza	0 D	18 M	12 M	18 M	10.5 M	18 M	18 M	4 M
Staple LX	10 M	0 D	24 M	10 M	10 M	10 M	10 M	6 M
Status	7 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D
Steadfast	0 D	10 M	10 M	18 M	15 D	10 M	18 M	4 M
Steadfast Q	0 D	10 M	10 M	18 M	15 D	10 M	18 M	4 M
Steadfast ATZ	10 M	10 M	10 M	18 M	10 M	10 M	18 M	8 M
Stinger	0 D	10.5 M	10.5 M	10.5 M	10.5 M	10.5 M	10.5 M	0 D
Storm	100 D	100 D	100 D	100 D	100 D	100 D	100 D	40 D
Stout	0 D	10 M	10 M	18 M	15 D	10 M	18 M	4 M
Strongarm	18 M	10 M	18 M	0 D	0 D	30 M	18 M	4 M
Suprend	7 M	7 M	7 M	7 M	7 M	18 M	7 M	3 M
SureStart II	0 D	26 M	12 M	26 M	Spring	18 M	26 M	4 M
Surpass	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Surpass NXT	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Surveil Co-Pack	9 M	9 M	9 M	9 M	0 D	30 M	30 M	3 M
Synchrony XP	7 M	8 M	9 M	30 M	0 D	30 M	9 M	3 M
Tillam	None	None	None	None	None	None	None	None
TopNotch	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Treflan	5 M	0 D	5 M	0 D	0 D	0 D	5 M	5 M
Trivence	10 M	18 M	18 M	18 M	0 D	18 M	18 M	4 M
Ultra Blazer	100 D	100 D	100 D	0 D	0 D	100 D	100 D	40 D
Valor SX/Valor EZ								
1.0 oz/A	7-30 D[21]	7-28 D[22]	30 D	0 D	0 D	30 D	30 D	30 D
1.5-2.0 oz/A	7-30 D[21]	7-28 D[22]	30 D	0 D	0 D	30 D	30 D	30 D
2.1-3.0 oz/A	14-30 D[21]	2 M	30 D	0 D	0 D	2 M	2 M	2 M
Valor XLT								
Soil pH<7.0	10 M	10 M	10 M	18 M	0 D	10 M	10 M	4 M
Soil pH>7.0	18 M	30 M	18 M	30 M	0 D	30 D	18 M	4 M
Verdict								
10-12 oz/A	0 D	Spring	0 D	Spring	1M[23]-2M[24]	Spring	Spring	4 M
13-15 oz/A	0 D	Spring	0 D	Spring	2M[23]-3M[24]	Spring	Spring	4 M
Warrant	0 D	0 D	0 D	Spring	0 D	Spring	Spring	4 M
WideMatch	0 D	18 M	12 M	10.5 M	10.5 M	10.5 M	10.5 M	0 D

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
M = months, D = days, Spring = The spring following application, --- = no information								
Xtendimax								
11 fl oz/A or less	0 D	0 D[25]/21[26] D	15 D	120 D	0 D[27]/14 D	120 D	120 D	15 D
22-33 fl oz/A	0 D	0 D[25]/120 D	120 D	120 D	0 D[27]/28 D	120 D	120 D	30-45 D
34-44 fl oz/A	0 D	0 D[25]/120 D	120 D	120 D	0 D[27]/120 D	120 D	120 D	45-60 D
Yukon	30 D	4 M	2 M	6 M	9 M	18 M	----	2 M
WideMatch	0 D	18 M	12 M	10.5 M	10.5 M	10.5 M	10.5 M	0 D
Zest	0 D	10 M	18 M	10 M	15 D	11 M	10 M	4 M
Zidua								
1.0 oz/A	0 D	1 M	6 M	4 M	0 D	4 M	18 M	1 M
2.0 oz/A	0 D	2 M	6 M	4 M	0 D	4 M	18 M	1 M
3.0 oz/A	0 D	4 M	10 M	4 M	0 D	4 M	18 M	4 M
4.0 oz/A	0 D	4 M	12 M	4 M	4 M	4 M	18 M	6 M
Zidua PRO	8.5 M	18 M	18 M	4 M	30 D	18 M	18 M	4 M
2,4-D	Only replant in the same growing season with crops registered for 2,4-D use							
2,4-DB	Only replant in the same growing season with crops registered for 2,4-DB use							

[1]Field corn may be planted 4 months after Authority MTZ was applied at 14 oz/A or less.
[2]Grain sorghum may be planted 12 months after Authority MTZ was applied at 20 oz/A or less.
[3]Rotation is 7 days when rates of 10 oz/A of Axiom or less have been applied; otherwise, wait 4 months to plant wheat.
[4]Clearfield corn, sunflower, and wheat
[5]Non-Clearfield corn, sunflower, and wheat
[6]DIREX USE PATTERN 1 = Banded DIREX Preemergence or Postemergence application only
[7]DIREX USE PATTERN 2 = Banded DIREX Preemergence and Postemergence or Broadcast DIREX Preemergence (and preplant) or Broadcast DIREX preemergence plus Banded DIREX postemergence applications.
[8]Reduced tillage production.
[9]Conventional tillage production.
[10]A field bioassay must be conducted for crops not listed on the label. To conduct a field bioassay, plant strips of the crop you want to grow the season following herbicide application and moniter for crop safety.
[11]STS tolerant soybeans only
[12]Crop rotation intervals are based on the cumulative amount of DIURON in LAYBY PRO applied to a site in the preceding 12 months.
[13]Use the longer interval within the ranges listed for crops grown on coarse textured soils with organic matter less than 2.0%.
[14]Application rates above 0.4 oz/A; follow the 18-month rotation interval for grain sorghum, non-STS tolerant soybeans, and field corn.
[15]Application rates 0.2 to 0.4 oz/A; follow the 4-month rotation interval for grain sorghum.
[16]Application rates 0.2 to 0.5 oz/A; follow the 6-month rotation if planting STS tolerant soybeans.
[17]Application rates 0.2 to 0.4 oz/A; no waiting interval for wheat.
[18]Application rates 0.5 oz/A; following the 4-month rotation interval for wheat.
[19]Use the longer interval within the ranges listed for replanting soybeans (i.e., 2 months for coarse textured soils with organic matter less than 2.0% and a 1 month for coarse textured soils with organic matter greater than or equal to 2.0%)
[20]Cotton may be planted after 12 months where SONIC was applied at rates of 5 oz/A or less and meet the following conditions: medium/fine soils; pH<7.2; and rainfall or irrigation exceed 15 inches after application.
[21]For **corn**: Plant a minimum of 14 days (minimum or strip-till) or 30 days after VALOR SX (conventional tillage system)
[22]For **cotton**: After Valor SX (2.0 oz/A or less) application, conduct strip till operation a minimum of 7 days before planting (regardless of crop residue levels). After conducting strip-till operation, apply Valor SX herbicide a minimum of 28 days before planting (<30% crop residue levels) or 21 days before planting (>30% crop residue levels).
[23]For coarse textured soils with less than 2% organic matter
[24]All other soil types.
[25]Bollgard II XtendFlex cotton varieties only.
[26]A minimum accumulation of 1 inch of rainfall or overhead irrigation and a waiting interval of 21 days following XTENDIMAX application prior to planting cotton.
[27]Roundup Ready 2 Xtend soybean varieties only.

WEED CONTROL IN FIELD CORN

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Balance Flexx 2 SC (*isoxaflutole*)	6.0 fl oz	0.094 lb	27	45 days	12 hours
Comments: BALANCE FLEXX is a RESTRICTED USE PESTICIDE. Apply BALANCE FLEXX up to 30 days before planting corn. Add MSO at 0.5 gal per 100 gal or COC at 1.0 gal per 100 gal of spray solution for weeds 3 inches or less in height. BALANCE FLEXX may be tank mixed with PARAQUAT, GLYPHOSATE, or 2,4-D if weeds are greater than 3 inches in height. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use BALANCE FLEXX on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). Do not apply more than 6.0 fl oz BALANCE FLEX per 365 day period. **Rainfast interval = N/A (suggest 1 hour).**					
Clarity/Banvel 4 S (*dicamba*)	8.0-16 oz	0.25-0.5 lb	4	---	24 hours
Comments: Apply any time prior to planting corn. Use 16 oz/A rate on medium to fine texture soils with >2.5% organic matter. Use 8 oz/A rate on coarse textured soils with less than 2.5% organic matter.					
Corvus 2.63 SC (*thiencarbazone* + *isoxaflutole*)	3.33 fl oz	0.012 lb + 0.031 lb	2 + 27	45 days	12 hours
Comments: CORVUS is a RESTRICTED USE PESTICIDE. Apply CORVUS up to 30 days before planting corn. Add MSO at 0.5 gal per 100 gal or COC at 1.0 gal per 100 gal of spray solution for weeds 6 inches or less in height. CORVUS may be tank mixed with PARAQUAT, GLYPHOSATE, or 2,4-D if weeds are greater than 6 inches in height. Do use seed or soil-applied CHLORPYRIFOS, TERBUFOS, PHORATE, FONOPHOS, and other organophosphate or carbamate insecticides in the same season as CORVUS. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use CORVUS on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). Do not apply more than 5.6 fl oz/A of CORVUS per 365 day period. **Rainfast interval = N/A (suggest 1 hour).**					
Direx 4 L (*diuron*)	0.5-0.8 qt	0.5-0.8 lb	7	---	12 hours
Comments: Apply any time from fall through spring prior to planting corn. Heavy textured soils will require higher application rate. DIREX 4L may be tank mixed with other burndown herbicides, consult tank mix partner label for more details. Plant corn at least 1.5" deep and make sure seed slot is closed. *Do not apply more than 1.6 qt/A of DIREX 4L per year.*					
ET 0.208 EC (*pyraflufen ethyl*)	0.5-2.0 oz	0.0008-0.003 lb	14	---	12 hours
Comments: Field corn may be planted any time after ET application. For best result, apply ET to broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter. Ground application requires minimum of 10 gallons/A.					

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Fierce 76WDG	3.0-4.5 oz			---	12 hours
(*flumioxazin*		0.063-0.094 lb	14		
+		+			
pyroxasulfone)		0.080-0.120 lb	15		
Comments: Apply FIERCE 7 to 30 days prior to planting field corn. Do not apply more than 4.5 oz/A of FIERCE during a single growing season. Add a COC or methylated seed oil at 1 to 2 pt/A or non-ionic surfactant at 0.25% v/v. Use only on no-till or minimum tillage fields where last year's crop residue has not been incorporated into the soil. Do not use on popcorn, sweet corn, or corn grown for seed. Tank mix partners include GLYPHOSATE, 2,4-D LVE, ATRAZINE, BASIS, EXPRESS, HORNET, PYTHON, RESOLVE, SIMAZINE, DICAMBA, PARAQUAT, or WEEDMASTER. Spray equipment, including mixing vessels and nurse tanks, must be cleaned each day following a FIERCE application.					
Keystone NXT 5.6 SC	1.4-3.0 qt			60 days	12 hours
(*acetochlor*		1.09-2.33 lb	15		
+		+			
atrazine)		0.88-1.88 lb	5		
Comments: KEYSTONE NXT is a RESTRICTED USE PESTICIDE. Apply KEYSTONE NXT up to 45 days prior to planting field corn; However, planting should be done as close as possible to the time of application of KEYSTONE NXT to provide effective weed control during critical early season corn development. For control of emerged weeds at the time of application, tank mix KEYSTONE NXT with GLYPHOSATE, LIBERTY, BANVEL, CLARITY, 2,4-D, or GRAMOXONE. Do not apply KEYSTONE NXT (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3.8 qt per of KEYSTONE NXT per season.					
Liberty 280 SL	29-36 oz			70 days	12 hours
(*glufosinate*)		0.53-0.66 lb	10		
Interline 2.34SL					
Comments: Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tank-mix partners.					
Glyphosate acid equivalent (ae)			9	---	4 hours
3 lb ae/gal	32-47 oz	0.75-1.13 lb ae			
4.17 lb ae/gal	23-45 oz				
4.5 lb ae/gal	22-32 oz				
Comments: Apply in 10-20 gal of water 2 to 4 weeks prior to your anticipated planting date to control existing groundcover. In most fields, a follow-up application of PARAQUAT will be needed at planting. Consult product label to determine if a surfactant is needed.					
2,4-D LVE	1.0-2.0 pt			---	48 hours
(various)		0.5-1.0 lb	4		
Comments: Apply 7 to 14 days prior to planting field corn. Do not use on a light, sandy soil, or where soil moisture is limiting weed growth. Very effective for cutleaf evening primrose control. Can be tank-mixed with other burndown herbicides (see label).					

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL 2 E (*paraquat*)	2.0-4.0 pt	0.5-1.0 lb	22	---	12 hours
Firestorm 3 S Parazone 3 S	1.3-2.7 pt				
Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Apply at planting as a follow-up to an earlier application of GLYPHOSATE. Provides better control of chickweed, henbit, purple deadnettle, and cutleaf eveningprimrose than GLYPHOSATE. Add NIS at 1 qt per 100 gal of spray solution. **Rainfast interval = 30 minutes.**					
Hornet 68.5 WDG (*flumetsulam* + *clopyralid*)	4.0-5.0 oz	0.046-0.057 lb + 0.125-0.156 lb	2 4	85 days	48 hours 14
Stanza 68.5 WDG					
Comments: Apply HORNET up to 30 days before planting corn. If weeds are present at time of application, tank mix HORNET with PARAQUAT, GLYPHOSATE, or 2,4-D. Add COC or NIS at 1.0-2.0 qt per 100 gal of spray solution. **Rainfast interval = 2 hours**.					
Leadoff 33.4 DF (*rimsulfuron* + *thifensufluron*)	1.5-2.7 oz	0.0157-0.0282 lb 0.0157-0.0282 lb	2 2	---	4 hours
Comments: Apply LEADOFF any time after harvest until right before planting corn. LEADOFF tank mix partners may include GLYPHOSATE, PARAQUAT, 2,4-D LVE, DICAMBA, or GLUFOSINATE. No additional surfactant is needed if tank mixed with GLYPHOSATE or LIBERTY with a built-in adjuvant system. Otherwise, add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal of spray solution plus an ammonium nitrogen fertilizer (AMS at 2 lb/A or UAN at 2 qt/A). Do not apply postemergence to corn.					
Resicore 3.29SC (*acetochlor* + *mesotrione* + *clopyralid*)	2.25-2.5 qt	1.58-1.75 lb + 0.17-0.19 lb + 0.11-0.12 lb	15 27 4	---	12 hours
Comments: Apply RESICORE up to 28 days before planting corn. RESICORE should be tank mixed with GLYPHOSATE, PARAQUAT, GLUFOSINATE, and/or 2,4-D for control of existing emerged weeds at the time of application. Do not apply more than 3.25 qt of RESICORE per acre per year. Do not make more than two applications of RESICORE per year. Do not apply RESICORE (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.					

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Sharpen 2.85SC (*saflufenacil*)	2.0-3.0 fl oz	0.045-0.067 lb	14	80 days	12 hours
Comments: Apply SHARPEN 14 to 30 days before planting corn. For optimum SHARPEN burndown activity, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). SHARPEN may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, HARNESS, HARNESS XTRA, VERDICT, PROWL H2O, OUTLOOK, GUARDSMAN MAX, and GUARDSMAN MAX LITE. Do not apply SHARPEN after corn emergence or severe crop injury will occur. Do not apply more than 6.0 fl oz (0.134 lb ai/A) of SHARPEN per cropping season. Do not apply SHARPEN where an at-planting application of an organophoshate or carbamate insecticide is planned or has occurred or severe crop injury may occur. However, SHARPEN may be applied when AZTEC or FORTRESS insecticides if applied at planting as a BAND, T-BAND, or IN-FURROW. SHARPEN may be applied with all other classes of at-planting insecticides including pyrethroids, neonictinoids, and fipronil. **Rainfast interval = 1 hour.**					
SureStart II 4.25 (*acetochlor* + *flumetsulam* + *clopyralid*)	1.5-3.0 pt	0.703-1.406 lb + 0.023-0.046 lb + 0.071-0.142 lb	15 + 2 + 4	85 days	12 hours
Comments: Apply SURESTART II up to 14 days before planting corn. For enhanced control of emerged weeds at the time of burndown application, SURESTART II may be tank mixed with GLYPHOSATE, 2,4-D, LIBERTY, or GRAMOXONE. Do not apply SURESTART II (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 pt/A of SURESTART II in a single application.					
Valor SX 51 WDG (*flumioxazin*)	2.0-3.0 oz	0.064-0.096 lb	14	---	12 hours
Comments: Apply 14 to 30 days prior to planting field corn. Do not apply more than 3 oz/A of VALOR SX during a single growing season. Do not irrigate when corn is emerging to the 2-leaf stage. Do not use on popcorn, sweet corn, or corn grown for seed. Can be tank-mixed with other burndown herbicides (see label).					
Verdict 5.57EC (*saflufencil* + *dimethenamid-p*)	10-15 fl oz	0.045-0.067 lb + 0.391-0.586 lb	14 + 15	80 days	12 hours
Comments: Apply VERDICT 14 to 30 days before planting corn. For optimum VERDICT burndown activity, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). VERDICT may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, and SHARPEN. Do not apply VERDICT after corn emergence or severe crop injury will occur. Do not apply more than 0.134 lb ai/A saflufenacil from all product sources per cropping season. Do not apply more than 25 fl oz of VERDICT per cropping season. Do not apply VERDICT where an at-planting application of an organophoshate or carbamate insecticide is planned or has occurred or severe crop injury may occur. However, VERDICT may be applied when AZTEC 2.1% granular, AZTEC 4.67 G granular, or FORTRESS 5G granular insecticides is applied at planting as a BAND, T-BAND, or IN-FURROW. VERDICT may be applied with all other classes of at-planting insecticides including pyrethroids, neonictinoids, and fipronil.					

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Zidua 0.85WG (*pyroxasulfone*)	1.5-3.0 oz	0.080-0.16 lb	15	--	12 hours

Comments: Apply ZIDUA 15 to 45 days before planting corn. ZIDUA tank mix partners include ATRAZINE, GLYPHOSATE, LIGHTNING, OUTLOOK, PROWL H2O, SHARPEN, and STATUS. On coarse textured soils, do not apply more than 2.75 oz/A of ZIDUA (0.142 lb ai/A of pyroxasulfone) per cropping season. On all other soil types, do not apply more than 5.0 oz/A of ZIDUA (0.266 lb ai/A of pyroxasulfone) per cropping season.

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Conservation Tillage Field Corn[1]

	ET[2]	Glyphosate[2]	Glyphosate + 2,4-D[2]	Glyphosate + Atrazine[2]	Glyphosate + Clarity[2]	Glyphosate + Direx[2]	Glyphosate + Leadoff[2]	Glyphosate + Sharpen[2]	Glyphosate + Valor SX[2]	Gramoxone[2]	Gramoxone + 2,4-D[2]	Gramoxone + Clarity[2]	Gramoxone + Valor SX[2]	Gramoxone + Direx[2]	Liberty[2]
barley, little	F	E	E	E	E	E	E	E	E	G	G	G	G	G	G
bluegrass, annual	G	F	F	E	F	E	E	E	E	G	G	G	G	G	P
buttercups	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E
chickweed, common	G	F	G	E	GE	GE	E	E	E	E	E	GE	E	E	E
clovers	P	PF	F	F	FG	F	G	E	F	G	G	GE	GE	GE	F
cudweed	G	E	E	E	E	E	E	E	E	FG	FG	FG	FG	FG	G
dandelion	P	P	E	GE	E	GE	E	G	G	N	E	GE	P	GE	FG
dock, curly	P	PF	G	G	GE	F	F	F	G	F	FG	GE	P	F	G
eveningprimrose, cutleaf	GE	PF	E	E	GE	GE	E	E	FG	F	E	GE	E	GE	G
geranium, Carolina	GE	FG	E	E	E	GE	E	E	E	GE	E	GE	E	E	GE
henbit/deadnettle	G	F	G	E	GE	E	E	E	E	G	GE	E	E	GE	G
horseweed (marestail)	G	E	GE	E	E	E	GE	E	GE	F	GE	E	GE	GE	GE
mustard, wild	G	FG	E	GE	G	GE	G	E	GE	FG	E	G	GE	G	GE
pansy, field	G	F	F	GE	F	G	---	E	F	G	G	G	G	GE	G
peanut, volunteer	F	F	F	F	G	F	P	GE	FG	P	F	GE	F	F	GE
pepperweed, Virginia	G	G	E	GE	GE	GE	E	E	G	G	GE	G	G	GE	G
radish, wild	G	FG	GE	GE	GE	GE	G	E	GE	G	GE	GE	GE	GE	GE
ryegrass, Italian	F	G	F	GE	F	FG	E	E	G	FG	FG	FG	FG	G	P
sorrel, red	F	E	E	E	E	E	G	G	E	E	E	E	E	E	PF
spurry, corn	G	GE	GE	GE	GE	GE	E	E	G	FG	G	G	G	G	---
swinecress	G	FG	G	G	G	G	E	E	FG	PF	FG	FG	PF	FG	GE
vetch	GE	F	E	E	E	G	E	E	FG	G	GE	GE	GE	G	GE
wheat/rye cover crop	P	E	E	E	E	G	E	E	E	FG	F	F	G	G	F

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Herbicide rates for burndown are Atrazine at 1.0 lb/A; ET at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; Direx at 1.6 pt/A; Leadoff at 1.5 oz/A; Sharpen at 1.0 oz/A; Gramoxone at 3.0 pt/A; Valor SX at 2.0 oz/A; and Liberty at 29 oz/A.

Weed Response to Soil Applied Preemergence Herbicides for Corn Weed Management[1]

	Acuron	Anthem	Anthem ATZ	Atrazine (ATZ)	Acetochlor	Acetochlor+ATZ	Alachlor	Alachlor+ATZ	Balance Flexx	Corvus	Dimethenamid-p	Hornet
anoda, spurred	G	---	GE	GE	---	GE	---	GE	---	---	---	G
barnyardgrass	FG	E	E	G	E	E	E	E	E	E	E	P
beggarweed, Florida	G	---	E	E	F	P	---	E	---	---	P	FG
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P
citronmelon	---	---	G	G	P	G	P	G	---	---	P	---
cocklebur, common	G	P	GE	GE	P	GE	P	GE	F	F	P	E
crabgrass	E	E	E	G	E	E	E	E	E	E	E	P
cowpea	E	P	E	E	P	E	P	E	GE	GE	P	G
crotalaria, showy	---	P	GE	GE	P	GE	P	GE	GE	GE	P	G
croton, tropic	E	P	G	G	P	G	P	G	GE	GE	P	P
crowfootgrass	E	GE	GE	G	E	E	E	E	E	E	E	P
dayflower, Benghal	GE	GE	GE	F	GE	GE	---	---	---	---	F	---
eclipta	GE	G	GE	GE	---	GE	---	GE	GE	GE	---	---
goosegrass	E	GE	GE	G	E	E	E	E	E	E	E	P
jimsonweed	E	---	E	E	P	E	P	E	E	E	P	GE
johnsongrass, seedling	E	---	---	P	P	P	P	P	GE	GE	P	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	---	---	E	E	F	E	FG	E	G	G	F	E
morningglory, annual	G	P	G	G	P	G	P	G	F	F	P	FG
nutsedge, purple	P	P	P	P	P	P	P	P	P	P	P	P
nutsedge, yellow	FG	P	P	P	F	FG	F	FG	P	P	FG	P
panicum, fall	E	GE	GE	P	E	E	E	E	GE	GE	E	P
panicum, Texas	F	F	F	P	PF	P	PF	PF	F	F	PF	P
pigweed	E	GE	E	E	G	E	G	E	E	E	G	E
ALS-resistant	E	GE	E	E	G	E	G	E	E	E	G	E
DNA-resistant	E	GE	E	E	G	E	G	E	E	E	G	E
poinsettia, wild	---	---	GE	GE	P	GE	P	GE	G	G	P	G
purslane, common	E	---	E	E	G	E	G	E	G	G	G	---
pusley, Florida	E	G	E	E	GE	E	GE	E	---	---	GE	G
ragweed, common	E	---	E	E	P	E	P	E	GE	GE	P	G
ryegrass, annual	---	GE	GE	---	---	---	---	---	---	---	---	P
sandbur, field	GE	GE	GE	P	FG	FG	FG	FG	F	F	FG	P
senna, coffee	GE	---	FG	FG	P	FG	P	FG	G	G	P	---
sesbania, hemp	GE	---	FG	FG	P	FG	P	FG	G	G	P	---
sicklepod	E	F	G	G	P	G	P	G	GE	GE	P	FG
sida, prickly	E	---	E	E	P	E	P	E	G	G	F	E
signalgrass, broadleaf	GE	FG	FG	P	G	G	FG	FG	G	G	G	P
smartweed, Pennsylvania	GE	P	GE	GE	P	GE	P	GE	GE	GE	P	G
spurge	GE	---	GE	GE	---	GE	---	GE	GE	GE	---	G
starbur, bristly	GE	---	GE	GE	PF	GE	P	GE	G	G	P	G
velvetleaf	E	P	G	G	P	G	P	G	G	G	P	E
vol. RR soybean	GE	P	GE	E	P	GE	P	GE	GE	GE	P	E
vol. peanut	G	P	GE	E	P	GE	P	GE	GE	GE	P	GE

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

Weed Response to Soil Applied Preemergence Herbicides for Corn Weed Management(cont)[1]

	Instigate	Lumax/Lexar	S-Metolachlor	S-Metolachlor+ATZ	Princep	Prowl	Python	Resolve	Sharpen	SureStart II	Verdict	Zidua
anoda, spurred	---	GE	---	GE	G	---	G	---	---	GE	---	---
barnyardgrass	GE	GE	E	E	G	GE	P	G	P	GE	E	E
beggarweed, Florida	---	E	F	E	G	---	FG	---	---	---	---	---
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P
citronmelon	---	---	P	G	F	---	---	---	---	G	---	---
cocklebur, common	G	GE	P	GE	G	P	E	G	G	GE	G	P
crabgrass	GE	GE	E	E	G	GE	P	G	P	GE	E	E
cowpea	---	E	P	E	G	P	G	---	E	E	G	P
crotalaria, showy	---	GE	P	GE	G	---	G	G	G	GE	P	P
croton, tropic	G	G	P	G	G	P	P	---	---	GE	---	P
crowfootgrass	GE	E	E	E	G	E	P	G	P	E	E	GE
dayflower, Benghal	---	---	GE	GE	---	---	---	---	---	---	F	GE
eclipta	G	GE	---	GE	GE	G	G	---	GE	GE	GE	G
goosegrass	GE	---	E	E	G	E	P	F	P	E	E	GE
jimsonweed	GE	E	P	E	E	P	GE	G	G	G	G	---
johnsongrass, seedling	GE	F	F	F	P	E	P	F	P	P	P	---
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	G	E	G	E	E	G	E	G	E	E	E	---
morningglory, annual	FG	G	P	G	G	P	FG	F	G	FG	G	P
nutsedge, purple	P	P	P	P	P	P	P	P	P	P	P	P
nutsedge, yellow	P	FG	FG	FG	P	P	P	P	P	P	FG	P
panicum, fall	GE	GE	E	E	G	FG	P	G	P	E	E	GE
panicum, Texas	GE	PF	PF	P	P	PF	P	F	P	PF	PF	F
pigweed	G	E	G	E	E	FG	E	FG	E	E	E	GE
ALS-resistant	G	E	G	E	E	FG	P	P	E	E	E	GE
DNA-resistant	G	E	G	E	E	P	E	FG	E	E	E	GE
poinsettia, wild	---	---	P	GE	G	P	G	---	---	GE	---	---
purslane, common	G	G	G	E	---	GE	---	---	---	GE	G	---
pusley, Florida	G	---	GE	E	G	E	G	---	F	GE	F	G
ragweed, common	G	E	PF	E	E	P	G	F	---	G	---	---
ryegrass, annual	GE	---	G	G	E	FG	P	F	P	---	---	GE
sandbur, field	GE	FG	FG	FG	G	GE	P	---	---		GE	GE
senna, coffee	G	---	P	F	---	P	FG	G	---	FG	---	---
sesbania, hemp	G	---	P	F	---	P	FG	G	---	FG	---	---
sicklepod	GE	G	P	G	G	P	FG	FG	GE	G	GE	F
sida, prickly	---	FG	P	E	E	P	E	F	G	G	F	---
signalgrass, broadleaf	FG	FG	FG	FG	P	GE	P	F	P	FG	FG	FG
smartweed, Pennsylvania	G	GE	P	GE	G	P	G	G	G	G	P	P
spurge	G	G	---	GE	G	G	---	---	GE	GE	G	G
starbur, bristly	---	G	P	GE	GE	P	G	---	P	G	P	---
velvetleaf	GE	G	P	G	G	P	E	F	G	E	G	P
vol. RR soybean	G	G	P	GE	G	P	P	P	---	GE	---	P
vol. peanut	F	G	P	GE	G	P	P	P	---	GE	---	P

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

Important Ground and Surface Water Considerations Regarding the Use of Atrazine and Simazine Containing Herbicide Products.

ATRAZINE and SIMAZINE users are strongly encouraged to follow label guidelines, discussed below, to share in the responsibility of preserving the future use of ATRAZINE and SIMAZINE. These restrictions apply to all formulations of ATRAZINE and SIMAZINE, and all pre-mix package products that contain ATRAZINE and SIMAZINE.

Application Rate Restrictions: For soils that are not defined as highly erodible, the maximum use rate for ATRAZINE is 2.0 lb ai (active ingredient) per acre and for SIMAZINE is 2.0 lb ai per acre per season. For soils classified as highly erodible (as defined by NRCS), If conservation tillage is practiced with at least 30 percent crop residue coverage at planting, the maximum use rate is 2.0 lb ai per acre for ATRAZINE and SIMAZINE. If crop residue coverage is less than 30 percent, then the maximum rate for ATRAZINE and SIMAZINE is 1.6 lb ai per acre. If ATRAZINE **was not** applied prior to corn emergence, then the total amount applied should not exceed 2.0 lb ai per acre. If ATRAZINE was applied to a field preemergence, then the total amount of ATRAZINE **should not** exceed 2.5 lb ai per acre per calendar year. The total amount of SIMAZINE **should not** exceed 2.0 lb ai per acre per calendar year.

Setbacks: Operations that involve mixing, loading, rinsing, or washing ATRAZINE or SIMAZINE within 50 feet of wells (including abandoned wells, drainage wells, or sink holes), rivers, intermittent streams, lakes, or reservoirs is prohibited. This restriction does not apply to operations within a properly designed impervious pads and diked mixing/loading areas. ATRAZINE or SIMAZINE must not be applied aerially or by ground equipment within 66 feet of points where field surface water enters perennial or intermittent streams and rivers or within 200 feet around natural or impounded lakes and reservoirs. If ATRAZINE or SIMAZINE is applied to highly erodible land, the 66 foot buffer or setback from runoff entry points must be planted to crop, seeded with grass, or other suitable crop.

If ATRAZINE or SIMAZINE is applied to tile-terraced fields containing standpipes, then users are advised to follow one the following restrictions: 1) do not apply ATRAZINE or SIMAZINE within 66 feet of standpipes; 2) After applying ATRAZINE or SIMAZINE to the entire field, immediately incorporate it to a depth of 2-3 inches; or 3) Apply ATRAZINE or SIMAZINE to the entire field under conservation tillage practices where high crop residue levels are present.

Examples of Herbicide Products that Contain Atrazine or Simazine

Trade Name	Active Ingredient(s)	Trade Name	Active Ingredient(s)
Aatrex	*atrazine*	Harness Xtra	*acetochlor + atrazine*
Bicep II Magnum	*atrazine + s-metolachlor*	Guardsman MAX	*dimethenamid-p + atrazine*
Bicep Lite II Magnum	*atrazine + s-metolachlor*	Keystone	*acetochlor + atrazine*
Bullet	*alachlor + atrazine*	Lariat	*alachlor + atrazine*
Cinch ATZ	*s-metolachlor + atrazine*	Lumax	*s-metolachlor + atrazine + mestrione*
Degree Xtra	*acetochlor + atrazine*	Marksman	*dicamba + atrazine*
Expert	*glyphosate + s-metolachlor + atrazine*	Princep	*simazine*
Fultime	*acetochlor + atrazine*	Steadfast ATZ	*nicosulfuron + rimsulfuron + atrazine*

Glyphosate-Resistant Palmer Amaranth Programs – Field Corn

Palmer amaranth populations have been documented in South Carolina to be resistant to acetolactate synthase (ALS) inhibiting herbicides (i.e., Accent, Resolve, Steadfast, and Option) and dinitroaniline (yellow) herbicides (i.e., Prowl), and glyphosate (i.e., Roundup, Touchdown). The following table is designed to aid producers in managing and/or preventing herbicide-resistant Palmer amaranth populations in corn.

Seed Program	Herbicide Program		
	PRE[1]	**POST[2]**	**POST-DIRECTED[3]**
Conventional Hybrids			
	atrazine, Harness, Bicep II Magnum, Cinch ATZ, Guardsman, Lexar, Corvus, Verdict, Sharpen, Bullet, Breakree, Balance Flexx, Acuron	dicamba, Status, 2,4-D, Impact, Laudis, Callisto, Capreno, atrazine, Armezon, Balance Flexx, Acuron	2,4-D, Evik, Lorox, Status, Clarity
	No PRE applied	dicamba, Laudis, Callisto, Impact Corvus, Capreno, Balance Flexx, Marksman, Buctril + atrazine	
Liberty-Link Hybrids			
	atrazine, Harness, Bicep II Magnum, Cinch ATZ, Guardsman, Lexar, Corvus, Verdict, Sharpen, Bullet, Breakree, Balance Flexx	Liberty + Banvel or Clarity, Liberty + dicamba Liberty + 2,4-D Liberty + Armezon Liberty + Warrant	2,4-D, Evik, Lorox, Status, Clarity
	No PRE applied	Liberty + atrazine + Callisto Liberty + dicamba Liberty + atrazine + Laudis Liberty + atrazine + Impact Liberty + atrazine + Warrant	
Roundup Ready Hybrids			
	atrazine, Harness, Bicep II Magnum, Cinch ATZ, Guardsman, Lexar, Corvus, Verdict, Sharpen, Bullet, Breakree, Balance Flexx	glyphosate + atrazine glyphosate + dicamba glyphosate + 2,4-D glyphosate + Armezon glyphosate + Warrant Halex GT	2,4-D, Evik, Lorox, Status, Clarity
	No PRE applied	glyphosate + s-metolachlor + atrazine glyphosate + atrazine + Laudis glyphosate + s-metolachlor + Callisto glyphosate + atrazine + Impact glyphosate + atrazine + Warrant Halex GT	

[1] PRE = Preemergence. Apply to soil surface after all tillage and planting has occurred.
[2] POST = Postemergence. Consult individual product labels for corn height restrictions, e.g., atrazine applied POST limited to corn 12 inches tall or less.
[3] Consult individual product label regarding specific corn height restrictions.

Preemergence Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Acuron 3.44 SC	2.5 qt			60 days	24 hours
(*s-metolachlor*		1.34 lb	15		
+		+			
atrazine		0.625 lb	5		
+		+			
mesotrione		0.15 lb	27		
+		+			
bicyclopyrone)		0.038 lb	27		
Comments: ACURON is a RESTRICTED USE PESTICIDE. Provides good to excellent control of most grass and broadleaf weeds. Tank mix partners include ATRAZINE, PRINCEP, GLYPHOSATE, and WARRIOR.					
Aatrex 4 SC	1.6-2.0 qt			60 days	12 hours
(*atrazine*)		1.6-2.0 lb	5		
Comments: ATRAZINE is a RESTRICTED USE PESTICIDE. Use to control mostly broadleaf weeds and a few grasses. Tank mix with ACETOCHLOR, S-METOLACHLOR, ALACHLOR, or DIMETHENAMID-P for improved grass control.					
Acetochlor			15	120 days	12 hours
(Breakfree 6.4 EC	1.5-2.5 pt	1.2-2.0 lb			
Harness 7 E	1.5-3.0 pt	1.3-2.6 lb			
Harness 20 G	6.0-10.0 lb	1.2-2.0 lb			
Surpass 6.4 EC	1.5-2.5 pt	1.2-2.0 lb			
Surpass NXT 7EC	1.25-2.25 pt	1.1-2.0 lb			
TopNotch 3.2 ME	2.0-3.0 qt	1.6-2.4 lb			
Degree 3.8 ME)	2.25-4.25 pt	1.1-2.0 lb			
Comments: HARNESS is a RESTRICTED USE PESTICIDE. Controls most annual grasses (*except Texas panicum*) and small-seeded broadleaf weeds. ACETOCHLOR can be tank-mixed with ATRAZINE for improved broadleaf weed control. Do not apply ACETOCHLOR to the following soils within 150ft (50ft for SURPASS/NXT) of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.					
Alachlor		2.0-2.75 lb	15	None	12 hours
(Micro-Tech 4 ME)	2.0-2.75 qt				
Comments: MICRO-TECH is a RESTRICTED USE PESTICIDE. Controls small seeded annual grasses (*except Texas panicum*) and broadleaf weeds.					
Anthem 2.15EC	5.0-10.0 fl oz			70 days	12 hours
(*pyroxasulfone*		0.082-0.163 lb	15		
+		+			
fluthiacet-methyl)		0.003-0.005 lb	14		
Comments: Provides small seeded grass and broadleaf weed control. Application rate is based on soil texture: coarse textured 5.0-8.0 fl oz/A; medium textured 6.5-10.0 fl oz/A. Tank mix with ATRAZINE, BALANCE, or HORNET for control of additional weed species.					

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Anthem ATZ 4.505 SC	1.75-2.5 pt			60 days	12 hours
(*atrazine*		0.88-1.25 lb	5		
+		+			
pyroxasulfone		0.106-0.152 lb	15		
+		+			
fluthiacet-methyl)		0.003-0.004 lb	14		
Comments: ANTHEM ATZ is a RESTRICTED USE PESTICIDE. Application rate is based on soil texture: coarse textured 1.75-2 pt/A; medium textured 2.0-2.5 pt/A. Provides small seeded grass and broadleaf weed control. Tank mix with ATRAZINE, BALANCE, or HORNET for control of additional weed species.					
Balance Flexx 2 SC	6.0 fl oz			45 days	12 hours
(*isoxaflutole*)		0.094 lb	27		
+	+	+			
atrazine 4 SC	1.5 qt	1.5 lb	5		
Comments: BALANCE FLEXX is a RESTRICTED USE PESTICIDE. Apply BALANCE FLEXX during planting (behind the planter after furrow closure) or after planting, but before weeds emerge. Failure to thoroughly close and firm the seed furrow may allow herbicide to directly contact seed which can cause injury. Controls *glyphosate- and ALS-resistant Palmer amaranth.* Add 1.5 lb/A ATRAZINE to enhance residual control of weeds. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use BALANCE FLEXX on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil).					
Bicep II Magnum 5.5 SC	1.3-2.1 qt			60 days	24 hours
(*s-metolachlor*		0.78-1.27 lb	15		
+		+			
atrazine)		1.0-1.63 lb	5		
Comments: BICEP II MAGNUM is a RESTRICTED USE PESTICIDE. *Application use rate is based on soil texture:* Sandy soils = 1.3-1.6 qt/A, Medium textured soils = 1.6-2.1 qt/A. Use higher rate for each soil type if applying in a reduced tillage system. Available as a pre-mix with glyphosate (EXPERT).					
Breakfree ATZ 5.25 SC	2.2-2.8 qt			60 days	12 hours
(*acetochlor*		1.65-2.1 lb	15		
+		+			
atrazine)		1.24-1.58 lb	6		
Comments: BREAKFREE ATZ is a RESTRICTED USE PESTICIDE. Application use rate is based on soil texture and organic matter content: Sandy soils = 2.2-2.6 qt/A, medium textured soils = 2.4-2.8 qt/A. Use higher rate for each soil texture if applying in a reduced tillage system. Do not apply BREAKFREE ATZ to the following soils within 150ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year. Do not apply ACETOCHLOR through any irrigation system or using aerial application equipment.					

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Bullet 4 ME Lariat 4 EC (*alachlor* + *atrazine*)	2.5-3.75 qt	 1.56-2.34 lb + 0.94-1.41 lb	 15 5	60 days	12 hours
Comments: BULLET and LARIAT are RESTRICTED USE PESTICIDES. *Application rate is based on soil type and organic matter:* Sandy soils = 2.5-3.0 qt/A, medium textured soils = 3.0-3.75 qt/A. Use higher rate for each soil type if applying in a reduced tillage system.					
Corvus 2.63 SC (*thiencarbazone* + *isoxaflutole*) + *atrazine* 4 SC	3.33 fl oz + 1.0 qt	 0.012 lb + 0.049 lb + 1.0 lb	 2 27 5	45 days	12 hours
Comments: CORVUS is a RESTRICTED USE PESTICIDE. Apply CORVUS during planting (behind the planter after furrow closure) or after planting, but before weeds emerge. Failure to thoroughly close and firm the seed furrow row may allow herbicide to directly contact seed which can cause injury. Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 1.0 lb/A ATRAZINE to enhance residual control of weeds. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use CORVUS on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil).					
Cinch ATZ 5.5 SC (*s-metolachlor* + *atrazine*)	2.6-3.2 pt	 0.78-0.96 lb + 1.0-1.24 lb	 15 5	60 days	24 hours
Comments: CINCH ATZ is a RESTRICTED USE PESTICIDE. *Application rate is based on soil type:* Sandy soils = 2.6 pt/A, medium textured soils = 3.2 pt/A. Use higher rate for each soil type if applying in a reduced tillage system.					
Dimethenamid-p (Outlook 6 EC)	 10-16 oz	0.47-0.75 lb	15	40 days	12 hours
Comments: Controls most annual grasses (*except Texas panicum*) and some broadleaf weeds. DIMETHENAMID-P may be tank-mixed with ATRAZINE or SIMAZINE.					
FulTime NXT 4.04 SC (*acetochlor* + *atrazine*)	2.0-3.7 qt	 1.35-2.50 lb 0.67-1.24 lb	 15 5	60 days	12 hours
Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. The application rate of FULTIME NXT is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.9 qt/A. For soils with 1.5% organic matter or more, the application rate range is 2.3-3.7 qt/A. Use only on sorghum seed treated with a safener. Do not apply FULTIME to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.					

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Hornet 68.5 WDG (*flumetsulam* + *clopyralid*)	4.0-5.0 oz	0.046-0.057 lb + 0.125-0.156 lb	2 4	85 days	48 hours
Stanza 68.5 WDG					
Comments: Apply HORNET at the time of planting or after planting, but prior to crop or weed emergence. Corn must be planted a minimum of 1.5 inches deep. Application of HORNET WDG or STANZA on soils with less than 1.5% organic matter may result in crop injury. Soil applied organophosphate insecticides should be applied in a T-band or a band to avoid potential crop injury. Do not apply HORNET WDG or STANZA if COUNTER (*terbufos*) or THIMET (*phorate*) insecticides were applied previously. Other corn insecticides should be applied in a T-band to avoid injury. *Do not plant cotton within 18 months of application*.					
Instigate 45.8 WDG (*rimsulfuron* + *mesotrione*)	6.0 oz	0.034 lb + 0.34 lb	2 27	None	12 hours
Comments: Apply INSTIGATE after corn planting but before crop emergence. Seed furrow must be firmly closed so that INSTIGATE spray does not contact the seed. Do not apply more than 0.0625 lb ai of RIMSULFURON (i.e., from LEADOFF, PREQUEL, REALM Q, or STEADFAST Q) during the crop year. Do not apply COUNTER (*terbufos*) within 60 days of a preemergence or preplant application of INSTIGATE. Do not apply INSTIGATE preemergence to coarse-textured soils (sand, loamy sand, or sandy loam) with less than 1% organic matter. INSTIGATE may be tank mixed with ATRAZINE, GLYPHOSATE, DICAMBA, 2,4-D, CINCH, or BREAKFREE.					
Keystone NXT 5.6 SC (*acetochlor* + *atrazine*)	1.4-3.0 qt	1.09-2.33 lb + 0.88-1.88 lb	15 5	60 days	12 hours
Comments: KEYSTONE NXT is a RESTRICTED USE PESTICIDE. Apply KEYSTONE NXT after planting (or after corn emergence up to 11 inches in height). Planting should be done as close as possible to the time of application of KEYSTONE NXT to provide effective weed control during critical early season corn development. Do not apply more than 3.8 qt per of KEYSTONE NXT per season. KEYSTONE NXT may be tank mixed with AIM, ATRAZINE, BALANCE PRO, BALANCE FLEXX, BANVEL, CALLISTO, CALLISTO XTRA, CLARITY, DISTINCT, DURANGO DMA, HORNET WDG, LINEX 4L, LOROX DF, MARKSMAN, PRINCEP, PYTHON WDG, RESOURCE, or 2,4-D.					
Lexar 3.7 SC (*s-metolachlor* + *mesotrione* + *atrazine*)	3.0 qt	1.31 lb + 0.17 lb + 1.31 lb	15 27 5	60 days	24 hours
Comments: LEXAR is a RESTRICTED USE PESTICIDE. Apply LEXAR after planting (or after corn emergence up to 12 inches in height). Do not apply more than 3.5 qt per acre of LEXAR per season. LEXAR may be tank mixed with 2,4-D, ATRAZINE, PRINCEP, GRAMOXONE, GLYPHOSATE, LIBERTY, and WARRIOR. Conduct a tank mix compatability test each time 2,4-D is added to the tank mixture with LEXAR. Temporary corn injury may occur if LEXAR is applied to emerged corn that has received an at-plant application of an organophosphate insecticide (except COUNTER). Do not make a postemergence application of LEXAR to emerged corn with any organophosphate or carbamate insecticide, or severe crop injury may occur. Do not apply a solo HPPD inhibitor postemergence (i.e., CALLISTO, IMPACT, or LAUDIS) to ground that has been treated with LEXAR in the same season.					

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Lumax 3.95 SC	2.5 qt			60 days	24 hours
(*s-metolachlor*		1.68 lb	15		
+		+			
mesotrione		0.17 lb	27		
+		+			
atrazine)		0.63 lb	5		

Comments: LUMAX is a RESTRICTED USE PESTICIDE. Apply LUMAX after planting (or after corn emergence up to 12 inches in height). Do not apply more than 3.0 qt per acre of LUMAX per season. LUMAX may be tank mixed with ATRAZINE, PRINCEP, GRAMOXONE, GLYPHOSATE, LIBERTY, and WARRIOR. Tank mixes with 2,4-D are allowed but should be done with extreme care with regard to compatability before mixing a load. 2,4-D batches vary greatly and should be tested for compatability each time a water or carrier source, water or carrier temperature, product source, or tank mixture recipe is changed.

Prowl H_2O 3.8 CS	1.55-3.13 pt	0.74-1.49 lb		21 days	24 hours
(*pendimethalin*)			3		
Prowl 3.3 EC	1.8-3.6 pt	0.74-1.49 lb			

Comments: Do not apply *pendimethalin* preplant incorporated or serious corn injury may result. Plant corn at least 1.5 in. deep. Corn seed must be completely covered with soil. Apply after planting before emergence of weeds. Use the higher rates on fine-textured soils. In case of stand failure, corn seed should be replanted below the herbicide treated zone. Add ATRAZINE at 1.0 to 2.0 qt/A for control of broadleaf weeds.

Python 80 WDG	1.0 oz			85 days	12 hours
(*flumetsulam*)		0.05 lb	2		

Comments: For areas where ATRAZINE cannot be used or in fields prone to flooding where soybeans may be re-planted. Plant corn at least 1.5" deep. Mix with a preemergence grass herbicide and apply on the surface. Soil applied organophosphate insecticides should be applied in a T-band or a band to avoid potential crop injury. Do not apply PYTHON if COUNTER or THIMET insecticides were applied previously. Other corn insecticides should be applied in a T-band to avoid injury. *Do not plant cotton within 18 months of application*.

Resicore 3.29SC	2.25-2.5 qt			---	12 hours
(*acetochlor*		1.58-1.75 lb	15		
+		+			
mesotrione		0.17-0.19 lb	27		
+		+			
clopyralid)		0.11-0.12 lb	4		

Comments: Apply RESICORE after planting corn into a clean seedbed. RESICORE may be tank mixed with ATRAZINE for enhance residual broadleaf weed activity. Do not apply more than 3.25 qt of RESICORE per acre per year. Do not make more than two applications of RESICORE per year. Do not apply RESICORE (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Resolve 25 DF	0.5-2.0 oz			30 days	4 hours
(*rimsulfuron*)		0.008-0.031 lb	2		

Comments: Controls most annual grasses and broadleaves including broadleaf signalgrass. For control of emerged weeds at the time of application, add NIS at 1 qt/100 gal or COC at 1 gal/100 gal of spray solution plus 2 qt/A of UAN (28-32% N) or 2 lb/A of spray grade AMS.

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
(*s*)-*metolachlor*			15	30 days	24 hours
(Dual 8E/II	1.5-2.0 pt	1.5-2.0 lb			
Dual 25G/II G Mag.	6.0-8.0 lb	1.5-2.0 lb			
Dual Mag.7.62 EC	1.0-1.33 pt	0.96-1.27 lb			
Dual II Mag. 7.64 EC	1.0-1.33 pt	0.96-1.27 lb			
Cinch 7.64 EC)	1.0-1.33 pt	0.96-1.27 lb			

Comments: METOLACHLOR and S-METOLACHLOR can be tank mixed with ATRAZINE. Generic formulations of METOLACHLOR are also available. DUAL II and DUAL II MAGNUM contain a safener that helps reduce the possibility of injury from S-METOLACHLOR applications.

Sharpen 2.85SC	2.0-3.0 fl oz			80 days	12 hours
(*saflufenacil*)		0.045-0.067 lb	14		

Comments: Apply SHARPEN after planting but before crop emergence. For control of weeds that are emerged at time of planting, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). SHARPEN may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, HARNESS, HARNESS XTRA, VERDICT, PROWL H2O, OUTLOOK, GUARDSMAN MAX, and GUARDSMAN MAX LITE. Do not apply SHARPEN after corn emergence or severe crop injury will occur. Do not apply more than 6.0 fl oz (0.134 lb ai/A of saflufenacil) of SHARPEN per cropping season. Do not apply SHARPEN where an at-planting application of an organophoshate or carbamate insecticide is planned or has occurred or severe crop injury may occur. However, SHARPEN may be applied when AZTEC or FORTRESS insecticides if applied at planting as a BAND, T-BAND, or IN-FURROW. SHARPEN may be applied with all other classes of at-planting insecticides including pyrethroids, neonictinoids, and fipronil.

SureStart II 4.25	1.5-3.0 pt			85 days	12 hours
(*acetochlor*		0.703-1.406 lb	15		
+		+			
flumetsulam		0.023-0.046 lb	2		
+		+			
clopyralid)		0.071-0.142 lb	4		

Comments: SURESTART II is a RESTRICTED USE PESTICIDE. Apply SURESTART II after planting (or after crop emergence up to 11 inches in height) into a clean seedbed. Plant corn at least 1.5" deep. Use of SURESTART II on soils with less than 1.5% organic matter may result in crop injury. If an ALS herbicide such as CANOPY, CLASSIC, PURSUIT, SCEPTER, or SQUADRON was applied in the previous year, apply SURESTART II to corn only if the rotational restrictions have been met. Extended cold, wet conditions following application of SURESTART II to corn during germination and early crop development may result in crop injury. Injury symptoms including yellowing leaves or stunting are usually temporary and plants recover without affecting yield. Soil applied organophosphate insecticides (except TERBUFOS or PHORATE) must be applied in a T-band or a band and not in-furrow to avoid potential crop injury. Do not use COUNTER (TERBUFOS) or THIMET (PHORATE) insecticides. Other corn soil insecticides from other classes of chemistry may be applied in-furrow, T-banded, or banded. Do not apply SURESTART II (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 pt/A of SURESTART II in a single application. *Do not plant cotton within 18 months of application*.

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Verdict 5.57EC (*saflufencil* + *dimethenamid-p*)	10-15 fl oz	 0.045-0.067 lb + 0.391-0.586 lb	 14 15	80 days	12 hours
Comments: Apply VERDICT after corn planting but before crop emergence. If weeds are present at planting, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). VERDICT may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, and SHARPEN. Do not apply VERDICT after corn emergence or severe crop injury will occur. Do not apply more than 0.134 lb ai/A saflufenacil from all product sources per cropping season. Do not apply more than 25 fl oz of VERDICT per cropping season. Do not apply VERDICT where an at-planting application of an organophoshate or carbamate insecticide is planned or has occurred or severe crop injury may occur. However, VERDICT may be applied when AZTEC 2.1% granular, AZTEC 4.67 G granular, or FORTRESS 5G granular insecticides is applied at planting as a BAND, T-BAND, or IN-FURROW. VERDICT may be applied with all other classes of at-planting insecticides including pyrethroids, neonictinoids, and fipronil.					
Warrant 3.0 ME (*acetochlor*)	1.5-2.75 qt	 1.125-2.063 lb	 15	---	12 hours
Comments: Apply WARRANT after corn planting but before weeds germinate. Provides residual control of small seeded broadleaves and grasses. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Labeled tank mix partners include AIM, BALANCE PRO, BALANCE FLEXX, CALLISTO, CLARITY, DISTINCT, GLYPHOSATE, LINEX 4L, LOROX DF, MARKSMAN, PRINCEP, RESOURCE, 2,4-D, ATRAZINE, and PARAQUAT. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Application of WARRANT followed by poor environmental conditions (cool wet soils and/or waterlogged soils) may result in crop response. Do not use WARRANT preplant, at-planting, or preemergence to sweet corn.					
Zidua 0.85WG (*pyroxasulfone*)	1.5-3.0 oz	 0.080-0.16 lb	 15	---	12 hours
Comments: Apply ZIDUA after planting corn but before crop emergence. Corn seed must be planted at least 1 inch deep. ZIDUA tank mix partners include ATRAZINE, GLYPHOSATE, LIGHTNING, OUTLOOK, PROWL H2O, SHARPEN, and STATUS. On coarse textured soils, do not apply more than 2.75 oz/A of ZIDUA (0.142 lb ai/A of pyroxasulfone) per cropping season. On all other soil types, do not apply more than 5.0 oz/A of ZIDUA (0.266 lb ai/A of pyroxasulfone) per cropping season.					

Weed Response to Postemergence Herbicides for Field Corn Weed Management[1]

	POSTEMERGENCE																			
	Acuron	Accent/NIC-IT	Aim	Atrazine (ATZ)	Balance Flexx	Basagran	Banvel/Clarity	Beacon	Buctril	Cadet	Callisto	Capreno	Corvus	Distinct/Status	Expert[2]	Glyphosate[2]	Halex GT[2]	Impact/Armezon	Keystone/Fultime[4]	Laudis	Liberty[3]
anoda, spurred	G	FG	P	E	---	P	GE	F	---	---	G	---	---	GE	E	GE	GE	---	E	---	G
barnyardgrass	FG	GE	P	GE	GE	G	P	P	P	G	G	GE	E	P	E	E	E	GE	GE	GE	G
beggarweed, Florida	G	G	F	G	GE	P	G	GE	G	G	G	GE	GE	GE	E	E	E	G	G	GE	GE
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	F	F	P	P	P	P
citronmelon	---	---	FG	E	GE	P	E	---	G	FG	G	GE	GE	E	E	E	E	---	E	---	E
cocklebur, common	G	F	G	E	G	E	E	GE	E	G	E	E	G	E	E	E	E	E	E	E	E
cowpea	GE	---	FG	G	GE	P	E	---	FG	FG	GE	GE	GE	E	G	G	GE	GE	G	GE	G
crabgrass	E	GE	P	G	G	P	P	P	P	P	P	GE	G	P	E	E	E	P	G	P	G
crotolaria, showy	---	---	F	GE	GE	P	G	---	G	G	---	GE	GE	GE	G	E	E	GE	GE	GE	G
croton, tropic	E	---	G	G	G	GE	GE	---	FG	G	P	G	G	GE	G	G	G	---	G	---	G
crowfootgrass	E	E	P	G	GE	P	P	P	P	P	P	---	---	P	E	E	E	P	G	P	G
dayflower, Benghal	F	---	GE	P	---	FG	P	---	---	---	---	---	---	---	---	F	F	---	---	---	PF
eclipta	GE	---	FG	GE	GE	FG	G	---	G	FG	G	GE	GE	GE	E	E	E	GE	---	GE	G
goosegrass	E	E	P	G	GE	P	P	P	P	P	P	E	G	P	E	E	E	P	G	P	G
jimsonweed	E	FG	G	E	E	E	E	E	E	G	E	E	E	E	E	GE	GE	GE	E	GE	G
johnsongrass, seedling	E	E	P	F	G	P	P	E	P	P	P	E	G	F	E	E	E	P	F	P	GE
johnsongrass, rhizome	P	GE	P	P	P	P	P	G	P	P	P	P	P	P	E	E	E	P	P	P	F
lambsquarters, common	GE	P	GE	E	GE	FG	E	PF	G	G	E	GE	GE	E	E	E	E	GE	E	GE	E
morningglory, annual	G	F	E	G	G	P	E	PF	G	G	GE	GE	G	E	FG	FG	GE	GE	G	GE	E
nutsedge, purple	P	P	P	P	F	P	P	P	P	P	F	F	F	P	G	G	G	P	P	P	P
nutsedge, yellow	FG	P	P	PF	F	G	P	PF	P	P	F	F	F	P	FG	FG	FG	P	PF	P	P
panicum, fall	E	G	P	G	G	P	P	G	P	P	P	E	G	F	E	E	E	P	G	P	G
panicum, Texas	F	GE	P	F	FG	P	P	PF	P	P	P	GE	F	P	E	E	E	P	F	P	F
pigweed	E	GE	G	E	E	P	GE	GE	G	G	E	GE	E	E	E	E	E	GE	GE	GE	FG
glyphosate-resistant	E	GE	G	E	E	P	GE	GE	G	G	E	GE	E	E	G	P	E	GE	GE	GE	FG
ALS-resistant	E	P	G	E	E	P	GE	P	G	G	E	GE	E	E	E	E	E	GE	GE	GE	FG
poinsettia, wild	---	---	---	---	---	---	G	---	---	---	---	---	---	GE	GE	GE	GE	---	---	---	---
purslane, common	E	---	G	E	---	P	E	---	---	---	---	---	---	E	G	G	G	---	---	---	G
pusley, Florida	E	P	FG	G	---	P	G	GE	E	---	---	GE	---	G	P	P	P	---	G	---	FG
ragweed, common	E	P	F	GE	---	G	E	---	G	---	F	E	---	E	E	GE	GE	F	GE	GE	E
ryegrass, annual	P	GE	P	FG	GE	P	P	FG	F	F	P	GE	GE	P	E	E	E	---	---	F	FG
sandbur, field	GE	E	P	F	G	P	P	PF	P	P	P	E	F	P	GE	GE	GE	P	F	P	G
senna, coffee	GE	FG	P	FG	---	P	E	FG	F	---	F	---	---	GE	GE	GE	GE	---	FG	---	G
sesbania, hemp	GE	PF	F	FG	GE	P	E	P	G	G	P	---	---	E	F	F	F	G	---	G	GE
sicklepod	E	PF	P	P	GE	P	GE	GE	P	G	P	P	GE	GE	E	E	E	GE	G	P	E
sida, prickly	E	P	F	GE	G	G	G	G	F	G	P	G	G	GE	E	G	G	---	GE	E	GE
signalgrass, broadleaf	GE	GE	P	F	P	P	P	P	P	P	P	GE	---	P	GE	GE	GE	P	F	P	G
smartweed, Pennsylvania	GE	G	G	G	---	E	E	G	GE	---	G	GE	---	E	G	G	G	GE	G	GE	E
spurge	GE	---	FG	GE	GE	F	G	G	GE	G	G	GE	GE	GE	E	E	E	GE	FG	G	G
starbur, bristly	GE	---	P	E	---	E	E	---	F	---	E	---	---	GE	E	GE	E	---	E	---	G
velvetleaf	E	F	E	G	E	GE	FG	PF	G	F	GE	E	E	GE	G	G	GE	GE	G	GE	GE
vol. peanut	FG	G	P	G	GE	P	G	F	P	P	P	GE	GE	GE	G	G	G	GE	G	GE	E
vol. RR soybean	GE	G	P	E	E	P	E	P	F	P	G	GE	E	GE	E	P	G	GE	E	GE	G

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Use only on glyphosate-tolerant (Roundup Ready, Roundup Ready 2, Agrisure GT) corn hybrids.

[3]Use only on Liberty Link corn hybrids.

[4]For control of listed weeds, these herbicides must be applied prior to weed emergence or tank mixed with a foliar active herbicide.

Weed Response to Postemergence Herbicides for Field Corn Weed Mgmt (cont)[1]

	POSTEMERGENCE															POSTEMERGENCE-DIRECTED				
	Marksman	Option	Prowl[4]	Pursuit[2]	Realm Q	Resolve	Resolve Q	Revulin Q	Sandea	Sequence[3]	Steadfast/Q	Steadfast ATZ	Stinger	Warrant[4]	2,4-D	Aim	Evik	Linex/Lorox	Gramoxone	2,4-D
anoda, spurred	GE	---	P	---	---	---	---	G	P	GE	FG	E	P	---	G	P	G	---	GE	G
barnyardgrass	P	G	GE	P	GE	G	GE	G	P	E	E	E	P	GE	P	G	E	E	G	P
beggarweed, Florida	FG	P	----	P	---	---	---	G	P	E	---	---	GE	---	P	---	E	E	E	P
bermudagrass	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P
citronmelon	G	P	----	PF	---	---	---	GE	PF	E	---	G	FG	---	E	G	G	E	F	E
cocklebur, common	E	G	P	E	---	P	PF	E	G	E	FG	E	GE	P	E	G	F	E	G	E
cowpea	E	P	---	P	---	---	---	GE	---	E	---	G	GE	P	E	---	G	G	G	E
crabgrass, large	P	FG	GE	F	G	F	F	GE	P	E	PF	FG	P	GE	P	P	E	G	G	P
crotolaria, showy	---	P	---	P	---	---	---	---	P	E	---	---	GE	---	G	G	E	E	G	G
croton, tropic	GE	P	P	PF	---	---	---	----	---	GE	---	GE	G	---	G	---	G	G	G	G
crowfootgrass	P	F	GE	F	F	PF	PF	GE	P	E	E	GE	P	G	P	P	E	E	G	P
dayflower, Benghal	---	P	---	FG	---	---	---	---	P	F	---	---	---	---	GE	---	GE	F	GE	GE
eclipta	G	---	G	GE	GE	G	G	G	P	E	---	---	---	G	G	FG	G	G	FG	G
goosegrass	P	F	GE	F	F	PF	PF	GE	P	E	P	GE	P	GE	P	P	E	E	G	P
jimsonweed	E	G	P	PF	G	P	P	GE	---	GE	G	E	G	G	E	GE	E	E	G	E
johnsongrass seedling	P	E	G	PF	F	PF	PF	GE	P	E	E	E	P	G	P	P	E	E	G	P
johnsongrass rhizome	P	G	P	P	P	P	P	G	P	E	G	GE	P	P	P	P	P	P	P	P
lambsquarters, common	E	G	P	P	G	PF	PF	GE	PF	GE	F	E	P	G	E	G	E	E	FG	E
morningglory spp.	E	F	P	FG	F	P	P	G	PF	G	G	G	P	FG	GE	G	G	G	G	GE
nutsedge, purple	F	P	P	G	PF	P	P	P	G	FG	P	P	P	P	P	P	G	F	F	P
nutsedge, yellow	F	P	P	F	F	P	P	F	GE	FG	P	PF	P	P	PF	P	G	F	F	PF
panicum, fall	P	G	GE	F	G	F	F	FG	P	E	G	G	P	GE	P	P	E	E	G	P
panicum, Texas	P	F	F	PF	G	F	F	F	P	E	G	E	P	G	P	P	GE	GE	E	P
pigweed	E	G	F	G	GE	PF	PF	GE	FG	E	G	E	G	G	GE	G	E	G	G	GE
glyphosate-resistant	E	G	F	G	GE	PF	PF	GE	FG	P	G	E	G	G	GE	G	E	G	G	GE
ALS-resistant	E	P	F	P	GE	P	P	GE	P	E	P	E	G	G	GE	G	E	G	G	GE
poinsettia, wild	---	P	---	E	---	---	---	---	---	E	---	E	---	---	---	FG	---	---	FG	---
purslane, common	---	P	---	P	---	---	---	---	---	E	---	E	---	---	G	G	E	G	G	G
pusley, Florida	GE	P	GE	PF	---	---	---	FG	---	FG	FG	GE	FG	FG	G	FG	E	G	FG	G
ragweed, common	E	G	P	P	G	P	P	FG	GE	GE	FG	E	G	F	E	P	E	E	G	E
ryegrass, annual	---	G	GE	P	F	G	G	G	P	E	F	F	P	GE	P	P	E	E	G	P
sandbur, annual	P	F	G	P	F	F	PF	G	P	E	PF	PF	P	GE	P	P	E	E	G	P
senna, coffee	GE	P	P	FG	---	---	---	G	----	GE	FG	FG	G	---	G	P	E	G	G	G
sesbania, hemp	GE	P	P	P	G	P	P	G	FG	GE	---	E	---	---	G	P	PF	G	PF	G
sicklepod	GE	F	P	P	F	---	---	FG	P	GE	PF	E	FG	P	E	P	E	E	G	E
sida, prickly	E	---	P	GE	F	P	P	FG	F	GE	P	GE	---	F	G	G	E	G	FG	G
signalgrass, broadleaf	P	F	GE	P	F	PF	PF	F	P	E	GE	GE	P	GE	P	P	GE	G	G	P
smartweed, Pennsylvania	E	PF	P	G	G	P	P	G	FG	GE	FG	GE	F	P	PF	G	G	G	FG	PF
spurge	G	---	G	G	---	---	---	---	---	E	---	GE	G	---	G	F	G	G	FG	G
starbur, bristly	GE	P	P	F	---	---	---	---	G	GE	---	E	FG	---	GE	---	E	G	G	GE
velvetleaf	E	G	P	G	G	PF	PF	G	E	G	F	G	---	G	G	E	G	G	GE	G
vol. peanut	E	P	P	P	---	---	---	---	P	G	G	G	FG	P	P	P	GE	G	P	P
vol. RR soybean	E	P	P	P	---	---	---	---	---	P	G	E	E	P	FG	P	E	P	G	GE

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Use only on Clearfield corn hybrids.

[3]Use only on glyphosate-tolerant (Roundup Ready, Roundup Ready 2, Agrisure GT) corn hybrids.

[4]For control of listed weeds, these herbicides must be applied prior to weed emergence or tank mixed with a foliar active herbicide.

Postemergence Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aatrex 4 SC (*atrazine*)	1.0-2.0 qt	1.0-2.0 lb	5	None	12 hours
Comments: Apply ATRAZINE to corn from emergence up to 12 inches in height. Add COC at 1 gal per 100 gal of spray mix. If ATRAZINE was not applied prior to corn emergence, up to 2 lbs ai/A may be applied. If an earlier ATRAZINE application was made, the total ATRAZINE applied may not exceed 2.5 lbs ai/acre per calendar year. **Rainfast interval not indicated on label (suggest 1 hour minimum).**					
Accent 75 DF (*nicosulfuron*) Accent Q 54.5 WDG NIC-IT 2 EC	0.67 oz 0.9 oz 2.0 oz	0.031 lb	2	30 days	4 hours
Comments: Apply ACCENT, ACCENT Q, or NIC-IT overtop or with drop nozzles to control rhizome johnsongrass 8 to 18" tall. ACCENT, ACCENT Q, and NIC-IT may be applied overtop corn up to 20 inches tall. For corn from 20 to 36 inches tall, use drop nozzles to avoid spraying in to the whorl of the plant. Add NIS at 1 qt/100 gal or COC at 1 gal/100 gal of spray mix plus 2 qt/A of UAN or 2 lb/A of AMS. Do not apply ACCENT, ACCENT Q, or NIC-IT to corn previously treated with COUNTER 15G, or COUNTER 20CR (in-furrow) unless hybrid is IR (imidazolinone resistant). Injury may occur when ACCENT, ACCENT Q, or NIC-IT is applied to corn previously treated with soil-applied THIMET, LORSBAN or COUNTER 20CR T-banded. In fields heavily infested with johnsongrass, apply only to virus tolerant hybrids. Do not use on sweet corn. Do not tank mix ACCENT, ACCENT Q, or NIC-IT with foliar-applied organophosphate insecticides as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours**.					
Acuron 3.44 SC (*s-metolachlor* + *atrazine* + *mesotrione* + *bicyclopyrone*)	1.25-2.5 qt	0.67-1.34 lb + 0.313-0.625 lb + 0.075-0.15 lb + 0.019-0.038 lb	15 + 5 + 27 + 27	60 days	24 hours
Comments: ACURON is a RESTRICTED USE PESTICIDE. Apply ACURON from emergence up to 12 inches in height before broadleaf weeds are greater than 3 inches in height. Do not apply ACURON in liquid fertilizer or severe crop injury may occur. ACURON applied alone will not provide consistent postemergence control of emerged grass weeds. Do not apply more than 2.5 qt/A of ACURON per growing season. Tank mix partners include ATRAZINE, ACCENT Q, STEADFAST Q, GLYPHOSATE, and WARRIOR. **Rainfast interval not indicated on label (suggest 1 hour minimum).**					
Aim 2 EC (*carfentrazone*) Aim 1.9 EW	0.5-1.0 fl oz	0.008-0.016 lb	14	3 days	12 hours
Comments: Apply AIM broadcast to corn from emergence until 8 leaf collar growth stage (V8). Excellent control of small sicklepod, *glyphosate-resistant Palmer amaranth*, and morningglory. Add a COC (1-2 gal/100 gals), NIS (1 qt/100 gals), or MSO (1-2 gal/100 gals). May be tank mixed with GLYPHOSATE for broader spectrum weed control in Roundup Ready corn. **Consult AIM product label regarding specific recommendations for preharvest intervals. **Rainfast interval = 6 hours**					

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Armezon 2.8SC	0.75-1.0 fl oz			45 days	12 hours
(*topramezone*)		0.016-0.022 lb	28		
+	+	+			
atrazine 4 SC	1.0-2.0 pt	0.5-1.0 lb	5		

Comments: Apply ARMEZON overtop corn from emergence up to 12 inches tall. For best results, add MSO or a COC at 1.0-1.5 gal per 100 gal of spray mix plus a fertilizer solution of UAN at 1.25-2.5 gal or spray grade AMS at 8.5-17 lb per 100 gal (use higher adjuvant rates for periods where hot dry weather is expected). Do not apply more than 1.0 fl oz/A per season. Good to excellent control of *glyphosate- and ALS-resistant and Palmer amaranth* (less than 6" tall). **Rainfast interval = 1 hour.**

Balance Flexx 2 SC	6.0 fl oz			45 days	12 hours
(*isoxaflutole*)		0.094 lb	27		
+	+	+			
atrazine 4 SC	1.0 pt	0.5 lb	5		

Comments: BALANCE FLEXX is a RESTRICTED USE PESTICIDE. Apply BALANCE FLEXX overtop on corn from spiking through the 2 leaf collar stage (V2). Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 0.5 lb/A ATRAZINE to enhance control of weeds larger than 6 inches (*restricts broadcast application to corn 12 inches tall or less*). Do not use COC or MSO with BALANCE FLEXX applied to emerged corn. Do not apply tank-mixes of BALANCE FLEXX with organophosphate or carbamate insecticides to emerged corn. Foliar applications of organophosphote or carbamate insecticides should not be made within 7 days of an application of BALANCE FLEXX. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use BALANCE FLEXX on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). **Rainfast interval = N/A (suggest 1 hour).**

Banvel/Clarity 4 S	0.5-1.0 pt			**	24 hours
(*dicamba*)		0.25-0.5 lb	4		

Comments: Apply BANVEL or CLARITY at the 1.0 pt rate overtop corn from the spike stage up to 8 inch tall corn or 5 leaf collar stage (V5) to provide early control of vines and broadleaf weeds. Apply the 0.5 pt/A rate from the 8 inch tall up to 36 inch tall corn or 15 days before tassel emergence, whichever comes first. For best performance, apply when weeds are less than 3 inches tall. Use directed applications when corn leaves prevent proper spray coverage, sensitive crops are growing nearby, or tank mixing with 2,4-D. Do not apply BANVEL or CLARITY under conditions which favor drift onto nearby crops. **Corn treated with BANVEL or CLARITY may be harvested or used for feed once the crop has reached the milk stage of development. **Rainfast interval not indicated on label (suggest 1 hour minimum).**

Basagran 4 S	1.5-2.0 pt			12 days	48 hours
(bentazon)		0.75-1.0 lb	6		

Comments: Treat when broadleaf weeds are small and actively growing. Do not apply to weeds that are under stress such as moisture or herbicide injury, as unsatisfactory control may result. Adjust rate according to weed size as indicated on the product label. Add COC to the spray tank at rate of 1 qt/A. Do not apply more than 4 pt per acre of BASAGRAN per season. **Rainfast interval = 4 hours.**

Beacon 75 DF	0.76 oz			60 days	12 hours
(*primisulfuron*)		0.036 lb	2		

Comments: Apply BEACON overtop, directed or semi-directed to control rhizome johnsongrass 8 to 16 inches tall. BEACON may be applied broadcast overtop corn up to 20 inches tall. Directed or semi-directed applications may improve weed coverage and minimize crop injury. Add NIS at 1.0 qt/100 gal of spray mix, or COC at 1.0 to 4.0 pt/A. *Do not apply BEACON to corn previously treated with COUNTER 15G, or COUNTER 20 CR (in-furrow) unless hybrid is IR (imidazolinone resistant).* Injury may occur where BEACON is applied to corn previously treated with soil-applied LORSBAN or COUNTER 20CR T-banded. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Buctril 4 EC	0.5-0.75 pt			45 days	24 hours
(*bromoxynil*)		0.25-0.38 lb	6		
+	+	+			
atrazine 4 SC	1.0-2.0 qt	1.0-2.0 lb	5		

Comments: Apply BUCTRIL overtop corn from 4 leaf growth stage (V4) up to before tassel emergence to control *glyphosate- and ALS-resistant and Palmer amaranth (less than 2 inches in height)*. Apply when weeds are in the 2- to 4-leaf stage or less than 6 inches tall. Less danger of volatility drift than 2,4-D or BANVEL. Tank mixtures with BANVEL, 2,4-D, or CLARITY may cause stalk brittleness. Tank mixes with liquid fertilizers may cause excessive leaf burn. **Rainfast interval not indicated on label (suggest 1 hour minimum).**

Cadet 0.91EC (*fluthiacet methyl*)	0.9 oz	0.006 lb	14	60 days	12 hours

Comments: Apply CADET broadcast to corn from 2 leaf growth stage (V2) up to 48 inches in height, but before tasseling. Excellent control of small sicklepod, *glyphosate-resistant Palmer amaranth*, and morningglory. Add either a COC (1-2 pt/A) or NIS (1 qt/100 gals) plus UAN at 1-2 qt/A or spray grade AMS at 8.5 lb/100 gals. May be tank mixed with glyphosate for broader spectrum weed control in Roundup Ready corn. Do not apply more than 1.25 oz/A CADET per season. **Rainfast interval = 4 hours.**

Callisto 4 SC	3.0 fl oz			45 days	12 hours
(*mesotrione*)		0.094 lb	27		
+	+	+			
atrazine 4 SC	1.0 qt	1.0 lb	5		

Comments: Apply CALLISTO + ATRAZINE overtop corn up to 12 inches tall. [Note: without ATRAZINE, CALLISTO may be applied to corn up to 30 inches tall or 8 leaf growth stage (V8)]. Provides good control of *glyphosate- and ALS-resistant and Palmer amaranth*. Apply before Palmer amaranth reaches 5 inches. Always add COC at 1 gal/100 gal of spray mix and UAN at a rate of 2.5% v/v or AMS at a rate of 8.5 lbs/100 gal. Do not use MSO adjuvants with CALLISTO as severe crop injury may occur. Do not apply more than 7.7 fl oz/A of CALLISTO per season. Do not make more than 2 applications of CALLISTO per season. Delay second application until 14 days after the first. **Rainfast interval = 12 hours.**

Capreno 3.45 SC	3.0 fl oz			45 days	12 hours
(*thiencarbazone*		0.013 lb	2		
+		+			
tembotrione)		0.068 lb	27		
+	+	+			
atrazine 4 SC	1.0 qt	1.0 lb	5		

Comments: Apply CAPRENO overtop on corn from the 1 leaf collar stage (V1) up to the 6 leaf collar stage (V6). Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 0.5 lb/A ATRAZINE to enhance control of weeds larger than 6 inches (*restricts broadcast application to corn 12 inches tall or less*). Add COC at 1 gal/100 gal of spray mix plus 1.5 qt/A of UAN or 1.5 lb/A of spray grade AMS. The use of NIS will decrease weed control performance. A sequential application of 3.0 fl oz can be made (wait a minimum of 14 days). Do not exceed 6.0 fl oz/A in a growing season. Do not use CAPRENO in the same season as LORSBAN, COUNTER, DYFONATE, or THIMET. Foliar applications of organophosphote or carbamate insecticides should not be made within 7 days of an application of CAPRENO. Certain corn hybrids are sensitive to ALS-inhibitor herbicide (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 1 hour.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Corvus 2.63 SC (*thiencarbazone* + *isoxaflutole*) + *atrazine*)	3.33 fl oz + 1.0 qt	 0.020 lb + 0.049 lb + 1.0 lb	 2 27 5	45 days	12 hours
Comments: CORVUS is a RESTRICTED USE PESTICIDE. Apply CORVUS overtop on corn from spiking through the 2 leaf collar stage (V2). Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 1.0 lb/A ATRAZINE to enhance control of weeds larger than 6 inches. Do not use COC or MSO with CORVUS applied to emerged corn. Do not apply tank-mixes of CORVUS with organophosphate or carbamate insecticides to emerged corn. Do not apply solo HPPD inhibitor postemergence herbicides (i.e., LAUDIS, CALLISTO, IMPACT) to corn that has been treated with CORVUS herbicide in the same growing season. Do not apply more than one application of CORVUS per 365 day period. Foliar applications of organophosphote or carbamate insecticides should not be made within 7 days of an application of CORVUS. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use CORVUS on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval not indicated on label (suggest 1 hour minimum).**					
Distinct 70 DG (*dicamba* + *diflufenzopyr*)	4.0-6.0 oz 	 0.138-0.207 lb + 0.054-0.80 lb	 4 19	**	12 hours
Comments: Apply overtop to corn between 4 and 24 inches tall. For corn 4 to 10 inches tall, use 6 oz/A. For corn 10 to 24 inches tall, use 4 oz/A. Use drop nozzles at the 4 oz/A rate as a rescue treatment for corn 24 to 36 inches tall. Always add NIS at 1 qt per 100 gal of spray mix. Do not use COC. DISTINCT provides excellent control of several broadleaf weeds, including *glyphosate- and ALS-resistant Palmer amaranth*. Do not apply under weather conditions that favor drift onto nearby, sensitive crops. Do not tank-mix with growth regulator herbicides, such as BANVEL or 2,4-D. **Do not harvest for corn grain and stover within 72 days of DISTINCT application or do not harvest corn for fodder within 32 days of DISTINCT application. **Rainfast interval = 4 hours.**					
Expert 4.88 L (*glyphosate* + *s-metolachlor* + *atrazine*)	2.5-3.75 qt 	 0.47-0.71 lb ae + 1.09-1.63 lb + 1.33-2.0 lb	 9 15 5	60 days	24 hours
Comments: USE ONLY ON GLYPHOSATE-TOLERANT (ROUNDUP READY, ROUNDUP READY 2, AGRISURE GT) CORN HYBRIDS! EXPERT is a RESTRICTED USE PESTICIDE. Apply EXPERT from emergence up till 12 inches tall corn. EXPERT provides excellent control of several broadleaf and grass weeds while providing residual control of weeds that have not emerged. **Rainfast interval = 2 hours.**					

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
FulTime NXT 4.04 SC	2.0-3.7 qt			60 days	12 hours
(*acetochlor*		1.35-2.50 lb	15		
+					
atrazine)		0.67-1.24 lb	5		

Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. Apply FULTIME NXT before corn exceeds 11 inches in height. Application rate is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.9 qt/A. For soils with 1.5% organic matter or more, the application rate range is 2.3-3.7 qt/A. FULTIME NXT may be applied before, with, or following postemergence herbicides in corn: AIM, ATRAZINE, BALANCE FLEX BANVEL, CALLISTO, CAPRENO, CLARITY, DISTINCT, DURANGO DMA, HORNET WDG, IMPACT, LAUDIS, LIBERTY, LINEX 4L, LOROX DF, MARKSMAN, RESOURCE, STATUS, or 2,4-D. Do not apply FULTIME NXT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.

Glyphosate (various) acid equivalent (ae)			9	50 days	4 hours
3 lb ae/gal	32 oz	0.75 lb ae			
4 lb ae/gal	24 oz				
4.17 lb ae/gal	23 oz				
4.5 lb ae/gal	22 oz				

Comments: USE ONLY ON GLYPHOSATE-TOLERANT (ROUNDUP READY, ROUNDUP READY 2, AGRISURE GT) CORN HYBRIDS! Apply GLYPHOSATE broadcast in corn up to the V8 growth stage (about 30" tall) before weeds exceed 4 inches in height. Use drop nozzles for 30-48" tall corn to avoid spraying in to the whirls of the plants. Allow a minimum of 10 days between applications. May be tank mixed with ATRAZINE (*application restricted to 12" tall corn*) for residual control. A single in-crop application must not exceed 1.12 lb ae/A. A sequential application must not exceed 1.12 lb ae/A (2.24 lb ae/A total for in-crop applications through 48 inch corn). **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Halex GT 4.39 SC	3.6-4.0 pt			45 days	24 hours
(*s-metolachlor*		0.94-1.05 lb	15		
+		+			
glyphosate		0.94-1.05 lb	9		
+		+			
mesotrione)		0.094-0.105 lb	27		

Comments: USE ONLY ON GLYPHOSATE-TOLERANT (ROUNDUP READY, ROUNDUP READY 2, AGRISURE GT) CORN HYBRIDS! Apply HALEX GT overtop corn from emergence up to 30 inches in height or the 8-leaf stage of corn growth. HALEX GT must be applied with a NIS at 1-2 qt/100 gal of spray mix. Use the higher rate of NIS when weeds are growing under stress conditions. In addition to NIS, add spray grade AMS at 8.5-17 lb/100 gal of spray mix. The use of UAN instead of AMS in not recommended due to risk of crop injury. If tank mixing HALEX GT with atrazine, do not apply when corn exceed 12 inches in height. Temporary crops response (transient bleaching) may occur under extreme weather conditions or when the crop is suffering from stress. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Hornet 68.5 WDG	2.0-5.0 oz			85 days	48 hours
(*flumetsulam*		0.023-0.057 lb	2		
+		+			
clopyralid)		0.063-0.156 lb	4		

Stanza 68.5 WDF

Comments: Apply HORNET or STANZA from emergence (spike stage) until corn reaches 20 inches in height (or the V6 growth stage). Include a NIS at 1 qt/100 gal or COC/MSO at 1 gal/100 gal of spray volume. Postemergence applications of HORNET or STANZA to corn previously treated with T-band, band, or in-furrow applications of other organophosphate insecticides, such as LORSBAN, AZTEC, FORTRESS, or DYFONATE, may cause temporary crop injury. Do not tank mix HORNET or STANZA with foliar postemergence organophosphate insecticides as severe crop injury may result. Foliar organophosphate insecticide should be applied as least 10 days before or after the application of HORNET or STANZA. Do not apply HORNET or STANZA if COUNTER (terbufos) or THIMET (phorate) insecticides were applied at planting. HORNET or STANZA may be tank mixed with other foliar non-organophosphate insecticides. *Do not plant cotton within 18 months of application*. **Rainfast interval = 2 hours.**

Impact 2.8 SC	0.75 fl oz			45 days	12 hours
(*topramezone*)		0.016 lb	28		
+	+	+			
atrazine 4 SC	1.0-2.0 pt	0.5-1.0 lb	5		

Comments: Apply IMPACT overtop corn from emergence up to 12 inches tall. For best results, add MSO at 1.0-1.5 gal per 100 gal of spray mix combined with a fertilizer solution of UAN at 1.25-2.5 gal per 100 gal of spray mix or spray grade AMS at 8.5-17 lb per 100 gal (use higher adjuvant rates for periods where hot dry weather is expected). Do not apply more than 0.75 fl oz/A per season. Good to excellent control of *glyphosate- and ALS-resistant and Palmer amaranth (*less than 6" tall). **Rainfast interval = 1 hour.**

Keystone NXT 5.6 SC	1.4-3.0 qt			60 days	12 hours
(*acetochlor*		1.09-2.33 lb	15		
+		+			
atrazine)		0.88-1.88 lb	5		

Comments: KEYSTONE NXT is a RESTRICTED USE PESTICIDE. Apply KEYSTONE NXT after emergence up to 11 inches in height. Do not apply more than 3.8 qt per of KEYSTONE NXT per season. Postemergence KEYSTONE NXT tank mix partners may include ACCENT, AIM, ATRAZINE, BALANCE FLEXX, BANVEL, BASIS, BASIS GOLD, BEACON, BUCTRIL, CALLISTO, CALLISTO XTRA, CAPRENO, CLARITY, DISTINCT, HORNET WDG, IMPACT, LAUDIS, LIBERTY, LIGHTNING, LINEX 4L, LOROX DF, MARKSMAN, PEAK, PERMIT, PROWL, PENDIMAX, PURSUIT, RESOURCE, SHOTGUN, SPIRIT, STATUS, STEADFAST, or 2,4-D.

Laudis 3.5 SC	3.0 fl oz			45 days	12 hours
(*tembotrione*)		0.082 lb	27		
+	+	+			
atrazine 4 SC	1.0 pt	0.5 lb	5		

Comments: Apply LAUDIS overtop on corn from emergence up to the 8 leaf collar stage (V8). Controls glyphosate- and ALS-resistant Palmer amaranth. Add 0.5 lb/A ATRAZINE to enhance control of weeds larger than 6 inches (restricts application to corn 12" tall or less). Add MSO at 1 gal per 100 gal of spray mix plus 1.5 qt/A of UAN or 1.5 lb/A of spray grade AMS. Do not use nitrogen fertilizer solution as the primary carrier for applying LAUDIS. Do not use NIS as weed control performance will be erratic. A second sequential 3 fl oz/A application can be made (wait a minimum of 7 days). Do not exceed 6 oz/A per growing season. **Rainfast interval = 1 hour.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Liberty 280 2.34 SL (*glufosinate*)	22-29 fl oz	0.40-0.53 lb	10	**	12 hours

Interline 2.34SL

Comments: USE ONLY ON CORN HYBRIDS CONTAINING THE LIBERTY-LINK TECHNOLOGY! Apply LIBERTY overtop on corn from emergence up to the 24-inch-tall corn (V7). For corn 24 to 36 inches tall, use drop nozzles. Avoid spraying into the whorl or leaf axils of the corn stalks. *Controls glyphosate- and ALS-resistant Palmer amaranth (less than 4")*. Use the 29 oz/A rate of LIBERTY when targeting Palmer amaranth. Always add AMS at 3 lb/A when applying LIBERTY. Do not add NIS or COC as it may increase crop response. Do not exceed 44 oz LIBERTY per acre per season. Do not use nitrogen solutions as spray carriers. **Do apply LIBERTY within 60 days of harvesting corn forage and within 70 days of harvesting corn grain and corn fodder. **Rainfast interval = 4 hours.**

Marksman 3.2 S	2.0-3.5 pt			60 days	24 hours
(*dicamba*		0.28-0.48 lb	4		
+		+			
atrazine)		0.53-0.92 lb	5		

Comments: MARKSMAN is a RESTRICTED USE PESTICIDE. Apply MARKSMAN overtop corn from emergence through the 5 leaf growth stage (V5) or 8 inches tall. Controls *glyphosate- and ALS-resistant Palmer amaranth*. Reduce MARKSMAN rate to 2.0 pt/A on coarse textured soils (sand, loamy sand, and sandy loam). Do not use COC after corn emergence as crop injury may result. A maximum of 5.25 pt/A per season is allowed. A NIS may be added to the spray tank. **Rainfast interval = 4 hours.**

Option 35 DF	1.5-1.75 oz			**	12 hours
(*foramsulfuron*)		0.003-0.038 lb	2		

Comments: Apply OPTION to corn from the V1 to the V6 growth stage. Use directed or drop nozzles for applications at the V7-V8 growth stage. Add methylated or ethylated seed oil at 1.5 pt/A in combination with a nitrogen fertilizer (1.5-2 qt/A of UAN or 1.5-3 lb/A of AMS). Do not use OPTION in the same season as COUNTER 15G (all uses), COUNTER 20CR (in-furrow), DYFONATE (all uses) and THIMET (all uses). Foliar applications of an OP insecticide should not occur within 7 days of an OPTION application. In fields heavily infested with johnsongrass, apply only to virus tolerant hybrids. **Do not apply OPTION within 70 days of harvesting grain or 45 days of harvesting corn forage. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 2 hours.**

Prowl H_2O 3.8 CS	2.0-3.0 pt			21 days	24 hours
(*pendimethalin*)		0.95-1.43 lb	3		
Prowl 3.3 EC	1.8-2.4 pt	0.75-1.0 lb			
+	+	+			
atrazine 4 SC	1.5-2.0 qt	1.5-2.0 lb	5		

Comments: Apply PROWL over-the-top after corn emergence up to 12-inch-tall (V4) corn but when seedling grasses are less than 1 inch tall. If ATRAZINE is not used, PROWL can be applied up to 30-inch-tall corn. Use the higher rates on fine-textured soils. In case of stand failure, corn seed should be replanted below the herbicide treated zone. **Rainfast interval not indicated on label (suggest 1 hour).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Realm Q 38.75DF	4.0 oz			70 days	12 hours
(*rimsulfuron*		0.019 lb	2		
+		+			
mesotrione)		0.078 lb	27		

Comments: Apply REALM Q over-the-top to corn from emergence up to 20 inches (or 7 or more collars visible), whichever is more restrictive. Add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal plus nitrogen fertilizer solution at 2 qt/A or ammonium sulfate at 2 lb/A. Do not apply more than 4.0 oz/A of REALM Q per growing season. If activating rainfall is not received within 7 days of application, a follow-up with cultivation or a sequential application of ACCENT Q or GLYPHOSATE may be needed. Do not tank mix REALM Q with BASAGRAN or severe crop injury may occur. Do not apply REALM Q within 45 days of crop emergence where COUNTER was applied since crop injury may occur. Do not tank mix RESOLVE Q with a foliar applied organophosphate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. To avoid crop injury, apply these products as least 7 days before or 3 days after application of REALM Q. Do not apply REALM Q aerially or apply through any type of irrigation system. Do not apply to field corn grown for seed. **Rainfast interval = 4 hours.**

Resicore 3.29SC	2.25-2.5 qt			45 days	12 hours
(*acetochlor*		1.58-1.75 lb	15		
+		+			
mesotrione		0.17-0.19 lb	27		
+		+			
clopyralid)		0.11-0.12 lb	4		

Comments: Apply RESICORE after corn emergence up to 11 inches in height. RESICORE may be tank mixed with ATRAZINE for enhanced broadleaf and grass weed control. For control of emerged grasses, tank mix RESICORE with ACCENT Q or STEADFAST Q in conventional corn. RESICORE may be tank mixed with GLYPHOSATE for glyphosate-tolerant corn or LIBERTY for glufosinate-tolerant corn. Apply RESICORE when weeds are small (1-2 inches in height). Do not apply RESICORE to emerged corn that has received an at-plant application of PHORATE or TERBUFOS insecticide or severe crop injury may occur. Postemergence applications of any organophosphate or carbamate insecticide within 7 days before or 7 days after a RESICORE application may result in severe corn injury. Do not apply more than 3.25 qt of RESICORE per acre per year. Do not make more than two applications of RESICORE per year. Do not apply RESICORE (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Resolve 25 DF	1.0 oz			30 days	4 hours
(*rimsulfuron*)		0.016 lb	2		

Comments: Apply RESOLVE 25DF overtop to corn from emergence up to 12-inch corn or 6 leaf collars visible, whichever is more restrictive. Provides suppression of Palmer amaranth. Add NIS at 1.0 qt per 100 gal plus nitrogen fertilizer at 2.0 qt/A or AMS at 2 lb/A. If rainfall is not received within 7 days of application, a follow-up cultivation or a sequential application of ACCENT may be needed. Do not apply more than 2.0 oz/A of RESOLVE 25 DF in a growing season. Do not tank mix RESOLVE 25 DF with BASAGRAN or severe crop injury may occur. Do not tank mix RESOLVE 25 DF with a foliar applied organophosphate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval not indicated on label (suggest 1 hour).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Resolve Q (mp) 22.4 DF	1.25 oz			30 days	4 hours
(*thifensulfuron* + *rimsulfuron*)		0.014 lb + 0.003 lb	2 + 2		

Comments: Apply RESOLVE Q over-the-top to corn from emergence up to 20-inch corn or 5 collars visible, whichever is more restrictive. Provides suppression of Palmer amaranth. Add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal plus nitrogen fertilizer solution at 2 qt/A or ammonium sulfate at 2 lb/A. If rainfall is not received within 7 days of application, a follow-up with cultivation or a sequential application of ACCENT may be needed. Do not apply more than 2.5 oz/A of RESOLVE Q in a growing season. Do not apply RESOLVE Q within 45 days of crop emergence where COUNTER was applied since crop injury may occur. Do not tank mix RESOLVE Q with BASAGRAN or severe crop injury may occur. Do not tank mix RESOLVE Q with foliar applied OP insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval not indicated on label (suggest 1 hour).**

Revulin Q 51.2DF (*nicosulfuron* + *mesotrione*)	3.4-4.0 oz		2 + 27	70 days	12 hours

Apply REVULIN Q over-the-top to corn from emergence up to 20-inch corn or 6 collars visible, whichever is more restrictive. For applications to corn from 20 to 30 inches tall, use drop nozzles only and avoid spraying into the whorl of the plant. Do not apply to corn after height exceeds 30 inches. Optimum application timing is when corn is 12 inches or less and weeds are small and actively growing. Add COC at 1 gal per 100 gal plus nitrogen fertilizer solution at 2 qt/A or ammonium sulfate at 2 lb/A. Do not use methylated seed oil adjuvants or blends with REVULIN Q. If activating rainfall is not received within 7 days of application, a follow-up with cultivation or a sequential application of ACCENT Q or GLYPHOSATE may be needed. Do not apply more than 4.0 oz/A of REVULIN Q in a growing season. Do not tank mix REVULIN Q with BASAGRAN or severe crop injury may occur. Do not apply REVULIN Q within 45 days of crop emergence where COUNTER was applied. Do not tank mix REVULIN Q with a foliar organophosate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. To avoid crop injury, apply these products as least 7 days before or 3 days after application of REVULIN Q. Do not apply REVULIN Q aerially or apply through any type of irrigation system. **Rainfast interval = 4 hours.**

Sandea 75WDG (*halosulfuron*)	0.67-1.33 oz	0.031-0.062 lb	2	30 days	12 hours

Comments: Apply SANDEA over-the-top to corn from emergence through the layby stage. Use drop nozzles after canopy prevents adequate coverage of weeds. Controls yellow and purple nutsedge. Add NIS at 1 qt per 100 gals spray solution. Tank mix partners include BANVEL, 2,4-D, BUCTRIL, and ATRAZINE. Please observe and follow the more restrictive application timings on the tank mix partner labels. Do not exceed 2.67 oz per acre per season. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Sequence 5.25 S	2.0-2.5 pt			50 days	24 hours
(*glyphosate*		0.56-0.71 lb ae	9		
+		+			
s-metolachlor)		0.56-0.70 lb	15		

Comments: USE ONLY ON GLYPHOSATE-TOLERANT (ROUNDUP READY, ROUNDUP READY 2, AGRISURE GT) CORN HYBRIDS! Apply SEQUENCE from emergence up till corn plants reach 30 inches tall. Applications from 30 to 48 inches require drop nozzles to ensure SEQUENCE does not contact the whorl of the plant. Do not exceed 3.5 pt/A in a single application or 5.0 pt/A total per year. Can be tank mixed with ATRAZINE for improved residual broadleaf weed control (consult label for additional tank mix choices). **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Status 56WDG	5-10 oz			**	24 hours
(*dicamba*		0.223-0.446 lb	4		
+		+			
diflufenzopyr		0.089-0.178 lb	19		
+		+			
isoxadifen)		safener			

Comments: Apply STATUS over-the-top on corn from V2 (4 inches tall) to V10 (36 inches tall) growth stages. Controls *glyphosate- and ALS-resistant Palmer amaranth*. Add NIS at 1 qt or COC at 1.0-2.0 pt/A or MSO at 1.0-2.0 pt/A per 100 gal plus nitrogen fertilizer at 5.0 qt per 100 gal or AMS at 8.5 lb/A. Do not apply under weather conditions that favor drift onto nearby, sensitive crops. Do not apply more than 12.5 oz/A of STATUS per season. Do not apply STATUS using a nitrogen fertilizer solution as a carrier. Do not apply if corn is more than 36 inches tall (V10 stage) or 15 days before tassel emergence, whichever comes first. **Do not harvest for corn grain and stover within 72 days of STATUS application or do not harvest corn for fodder within 32 days of STATUS application. **Rainfast interval = 4 hours.**

Steadfast 75DF	0.75 oz			30 days	4 hours
(*nicosulfuron*		0.023 lb	2		
+		+			
rimsulfuron)		0.012 lb	2		

Comments: Apply STEADFAST over-the-top corn up to 20" tall or 6 collars (V6), whichever is more restricitve. Add COC at 1 gal per 100 gallons or NIS at 1 qt per 100 gallons. Add nitrogen fertilizer solution at 2 qt/A or AMS at 4 lb/A. Do not apply to corn previously treated with COUNTER 15G, or COUNTER 20CR (in-furrow). Injury may occur when STEADFAST is applied to corn previously treated with soil applied LORSBAN, THIMET, or COUNTER 20CR T-banded. Do not tank mix STEADFAST or with BASAGRAN or LADDOCK or severe crop injury may occur. Do not tank mix STEADFAST with a foliar applied organophosphate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Steadfast Q 37.7 WDG	1.5 oz			30 days	4 hours
(*nicosulfuron*		0.023 lb	2		
+		+			
rimsulfuron)		0.012 lb	2		

Comments: Apply STEADFAST Q over-the-top corn up to 20" tall or 6 collars (V6), whichever is more restrictive. Add COC at 1 gal per 100 gallons or MSO at 0.5 gal per 100 gallons or NIS at 1 qt per 100 gallons plus a nitrogen fertilizer solution at 2 qt/A (28 to 32% N) or spray grade AMS at 4lb/A. Do not apply to corn previously treated with COUNTER 15G, or COUNTER 20CR (in-furrow). Injury may occur when STEADFAST Q is applied to corn previously treated with soil applied LORSBAN, THIMET, or COUNTER 20CR. Do not tank mix STEADFAST Q with BASAGRAN or LADDOCK or severe crop injury may occur. Do not tank mix STEADFAST or STEADFAST Q with a foliar applied organophosphate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Do not tank mix with 2,4-D or severe grass control antagonism may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

Steadfast ATZ 89.3 WDG	14 oz			60 days	12 hours
(*nicosulfuron*		0.024 lb	2		
+		+			
rimsulfuron		0.011 lb	2		
+		+			
atrazine)		0.75 lb	5		

Comments: Apply STEADFAST ATZ over-the-top corn from emergence up to 12 inches tall or up and exhibiting 6 collars (V6). Add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal of spray mix plus 2 qt/A of UAN or 2 lb/A of AMS. Do not apply STEADFAST ATZ to corn previously treated with a soil insecticide such as COUNTER 15G, COUNTER 20CR (in-furrow), THIMET, LORSBAN, or COUNTER 20CR (T-banded). Do not tank mix STEADFAST ATZ with any 2,4-D containing products as severe grass control antagonism may occur. Do not tank mix STEADFAST ATZ with BASAGRAN or LADDOCK or severe crop injury may occur. Do not tank mix STEADFAST ATZ with a foliar applied organophosphate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., or severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

Stinger 3.0SL	0.33-0.67 pt			---	12 hours
(*clopyralid*)		0.124-0.25 lb	4		

Comments: Apply STINGER over-the-top corn from emergence up to 24 inches tall to control small broadleaf weed species. Use higher rate for larger weeds. Apply with ground equipment as a broadcast spray in 10 gallons of water or more to ensure uniform and through spray coverage of the weed foliage. STINGER may be tank mixed with HORNET WDG. See label for additional information. Corn inbred lines or breeding stock may be injured by STINGER. Do not apply more than 0.67 pt STINGER per acre per year. Do not allow livestock to graze treated areas or harvest treated corn silage as feed within 40 days after last treatment. **Rainfast interval = 6 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
SureStart II 4.25 (*acetochlor* + *flumetsulam* + *clopyralid*)	1.5-3.0 pt	0.703-1.406 lb + 0.023-0.046 lb + 0.071-0.142 lb	15 + 2 + 4	85 days	12 hours

Comments: Apply SURESTART II from planting until corn reaches 11 inches in height. Do not apply SURESTART II postemergence if corn was previously treated with COUNTER (TERBUFOS) or THIMET (PHORATE) as severe crop injury may result. Postemergence applications of SURESTART II to corn previously treated with T-band, band, or in-furrow applications of other organophosphate insecticides, such as LORSBAN, AZTEC, or FORTRESS insecticide may cause temporary crop injury. Do not tank mix SURESTART II with foliar postemergence organophospate insecticides as severe crop may result. To avoid crop injury, apply the foliar organophosate insecticide at least 10 days before or 10 days after the application of SURESTART II. Do not apply SURESTART II to sweet corn or popcorn. *Do not plant cotton within 18 months of application*. Do not apply SURESTART II (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 pt/A of SURESTART II in a single application.

Warrant 3.0ME (*acetochlor*)	1.5-3.0 qt	1.13-2.25 lb	15	40 days	12 hours

Comments: Apply WARRANT over-the-top to corn from seedling emergence until corn reaches 30 inches in height. Drop nozzles are recommended for optimum spray coverage and weed control when corn height is 24 to 30 inches. Weeds emerged at time of application will not be controlled by WARRANT. If weeds are emerged at time of application, tank mix a labeled postemergence corn herbicide with WARRANT. Do not make a postemergence surface application using a sprayable fluid fertilizer as the carrier because severe crop injury may occur. Do not exceed 4 qt per acre per season when making a second application of WARRANT. Do not use WARRANT on sweet corn. Tank mix partners include 2,4-D, ATRAZINE, AIM, AXIOM, BALANCE, DICAMBA, DISTINCT, PYTHON, RESOURCE, GLYPHOSATE, LOROX, CALLISTO, MARKSMAN, PROWL, and RESOLVE.

2,4-D 4S (various)	0.5-1.0 pt	0.25-0.5 lb	4	7 days	48 hours

Comments: Apply 2,4-D over-the-top to corn under 8" tall (to top of canopy). If corn is more than 8 inches tall, use drop nozzles to keep spray out of the whorls. Do tank mix with ATRAZINE, oil, or other adjuvants. Do not apply from tasseling to hard dough stage. Corn treated with 2,4-D may become temporarily brittle. Wind or cultivation may cause stem breakage during that time period. Make no more than one application per crop cycle. Do not apply more than 1.0 pt/A per application. Controls *glyphosate- and ALS-resistant Palmer amaranth*. Do not apply under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval not indicated on label (suggest 1 hour).**

Postemergence Directed Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
2,4-D 4S amine or low volatile ester	0.5-1.0 pt	0.125-0.25 lb	4	7 days	48 hours
Comments: Apply 2,4-D as a postemergence directed spray from 8 inches tall up to tasseling using drop nozzles to minimize contact with corn plant. If corn plants are growing rapidly, reduce 2,4-D rate to 0.5 pt to minimize crop injury potential.					
Aim 2EC (*carfentrazone*) Aim 1.9EW	0.5-2.0 fl oz	0.008-0.031 lb	14	**	12 hours
Comments: Apply AIM as a postemergence directed spray from V8 to V14 growth stage. Add a COC at 1-2 gal per 100 gals, NIS at 1 qt per 100 gals, or MSO at 1-2 gal per 100 gals of spray mixture. Avoid directing the spray in the whorl of the plant. **Consult AIM product label regarding specific recommendations for preharvest intervals.					
Evik 80WDG (*ametryn*)	0.75-2.0 lb	0.6-1.6 lb	5	30 days	12 hours
Comments: Apply EVIK as a postemergence directed spray after the smallest corn is at least 12 inches tall (measured from the highest leaf surface on free-standing plants). Apply in a minimum of 20 gallons of water per acre. Coverage is important for weed control performance. Add NIS at a rate of 2 qt per 100 gals of spray mixture. Do not spray over top of corn or injury will occur. Do not make more than one application per year. Do not apply within 3 weeks of tasseling.					
Gramoxone SL 2E (*paraquat*) Parazone 3 S Firestorm 3 S	1.0-2.0 pt 0.7-1.3 pt	0.25-0.5 lb 0.26-0.49 lb	22	7 days	12 hours
Comments: Apply PARAQUAT as a postemergence directed spray when corn is at least 10 inches tall. A hooded or shielded sprayer is recommended to minimize spray contact with corn foliage. Apply in a minimum of 10 gallons of water per acre. Coverage is important for weed control performance. Weeds 6 inches or taller may not be controlled. Add NIS at a rate of 1 qt per 100 gals of spray mixture. If using drop nozzles, arrange nozzles to spray no higher than lower 3 inches of the corn stalks. Corn plants shorter than 10 inches may be injured and not recover. For corn greater than 20 inches in height, arrange nozzles to spray no higher than the lower 1/3 of the corn stalks. Corn foliage sprayed will be injured but crop will recover and develop normally. Do not apply more than 3 applications of PARAQUAT post-directed per year.					
Linex 4L (*linuron*) Lorox 50DF	1.25-3.0 pt 1.25-3.0 lb	0.63-1.5 lb 0.63-1.5 lb	7	57 days	24 hours
Comments: Apply LINEX or LOROX as a postemergence directed spray when corn is at least 15 inches tall. Apply when there is sufficient height differential between weeds and the crop so that the directed spray thoroughly covers all weed foliage without contact of upper leaves or whorl of the corn by spray or drift. Add NIS at a rate of 2 qt per 100 gals of spray mixture. Spray to cover weeds no more than 3 to 4 inches tall. Use lower rate when weeds are no taller than 2 inches and higher rate for weeds up to 4 inches tall. Non-pressure nitrogen solution may be substituted for all or part of the water carrier.					

Harvest Aids for Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
2,4-D 4S amine or low volatile ester	1.0-3.0 pt	0. 25-1.5 lb	4	7 days	48 hours
Comments: Apply 2,4-D broadcast after the hard dough or dent growth stage to control weeds that interfere with harvest. Make no more than one application per crop cycle. Do not apply more than 3 pints per acre per application.					
Aim 2EC (*carfentrazone*)	1.0-2.0 fl oz	0.008-0.031 lb	14	7 days	12 hours
Aim 1.9EW					
Comments: Apply AIM after physiological maturity (less than 35% moisture and the black layer has formed). Desiccates annual morningglory and other weedy harvest impediments. Add a COC at 1-2 gal/100 gals, NIS at 1 qt/100 gals, or MSO at 1-2 gal/100 gals to the spray mix. Apply in spray volumes with a minimum of 10 gal/A					
Glyphosate acid equivalent (ae)			9	7 days	12 hours
3 lb ae/gal	32 oz	0.75 lb ae			
4 lb ae/gal	24 oz				
4.17 lb ae/gal	23 oz				
4.5 lb ae/gal	22 oz				
Comments: Apply GLYPHOSATE after physiological maturity (less than 35% moisture and the black layer has formed). Consult GLYPHOSATE product label for recommendations on adjuvants and other additives. Not recommended for corn grown for seed.					
Parazone 3 S (*paraquat*)	0.8-1.3 pt	0.3-0.49 lb	22	7 days	12 hours
Firestorm 3 S					
Comments: Apply PARAQUAT 3S in a minimum of 20 gallons of spray per acre by ground or 5 gallons of spray per acre by air after corn is mature. A black layer at the base of each kernel indicates maturity. Add a NIS at 1 qt/100 gal of spray solution. Use the higher rate to desiccate mature broadleaf weeds and grasses. Drought stressed plants can be difficult to kill and desiccation may not be complete. Make only 1 preharvest application of PARAQUAT 3S per year.					

CORN INSECT CONTROL

Francis P. F. Reay-Jones, Extension Entomologist

Grain yield reductions and losses in grain quality due to insect pests are a constant problem in the Southeast. Control options include cultural practices to prevent or avoid injury, transgenic Bt corn, at-planting insecticides (including seed treatments), and foliar insecticides. Insect pressure varies greatly from field to field. Decisions concerning pest management options should therefore be made in careful consideration of the history of insect problems in each field where corn is to be planted.

Major insect pests of corn in South Carolina.

Insect	Description of feeding habit	Methods of control
Wireworms	Feed on planted kernels resulting in poor germination and stunted seedlings	Insecticide, tillage, control of winter weeds
Cutworms	Girdling of stalk at soil surface	Avoid planting corn on sod or weedy land, selected Bt hybrids, insecticides
Sugarcane beetles	Burrow into stalk above base of roots	Plant early and do not plant corn after sod
Billbugs	Chew into stalk and cause bud leaves to wilt and die	Crop rotation, weed removal in and around corn field, insecticides
Corn earworms	Feed on leaves in whorl and on ear tissue near ear tip	Insecticides, selected Bt hybrids, plant early
Fall armyworms	May feed on all above ground parts of corn plant	Bt hybrid, insecticides, plant and harvest early, control grassy weeds
Lesser cornstalk borers	Tunnel into corn seedling	Crop rotation and early planting, selected Bt hybrids, insecticides

Several types of Bt corn are available, each characterized by an 'event' (i.e. a successful insertion of the genetic package into a plant) and cry proteins. In a nutshell, there are Bt traits for above-ground pests and Bt traits for rootworms. Please refer to table below for efficacy of available products.

Bt traits for above-ground pests.

- Herculex I (event TC1507, protein Cry1F).
- Optimum Intrasect (events TC1507 and MON810, proteins Cry1F and Cry1Ab).
- Optimum Leptra (events TC1507, MON810, and MIR162, proteins Cry1F, Cry1Ab and Vip3Aa20).
- YieldGard CB (event MON810, protein Cry1Ab).
- Genuity VT Double Pro (event MON89034, proteins Cry1A.105 and Cry2Ab2).
- Agrisure Artesian 3010A (event Bt11, protein Cry1Ab).
- Agrisure GT/CB/LL (event Bt11, protein Cry1Ab).
- Agrisure Viptera 3110 (events MIR162 and Bt11, proteins Vip3Aa20 and Cry1Ab).
- Agrisure Viptera 3220 (events MIR162, TC1507, proteins Vip3Aa20, Cry1Ab and Cry1F)
- PowerCore (events MON89034 and TC1507, proteins Cry1A.105, Cry2Ab2, and Cry1F)
-

All products provide excellent control of stalk borers (European corn borer, southern cornstalk borer). The activity in seedling and whorl stage is greater in Herculex I, which provides good early season control of cutworms, lesser corn stalk borer, and fall armyworm. YieldGard CB and Agrisure CB/LL have fair activity for corn earworm infestations in corn ears, whereas control with Herculex I is poor. The more recent Genuity VT Double Pro is the first Bt corn to have

two genes expressing Bt toxins to control above ground Lepidopteran pests. The major advantage relative to the previously mentioned products is that it provides good to very good control of corn earworm and very good control of fall armyworm. The new Vip3Aa20 protein that is included in Agrisure Viptera hybrids and in Optimum Leptra hybrids will also provide excellent control of corn earworm and fall armyworm. These hybrids may be particularly useful in late planted and no-till corn.

Bt traits for rootworms.

- Herculex RW (event DAS59122-7, protein Cry34/35Ab1).
- YieldGard Rootworm (event MON863, protein Cry3Bb).
- YieldGard VT Rootworm/RR2 (event MON88017, protein Cry3Bb).
- Agrisure RW (event MIR604, protein mCry3A).

All products provide control of western corn rootworms (but no control of grubs and wireworm). Western corn rootworms are not currently widespread pests in South Carolina, and these products should generally not be needed.

Stacked Bt traits for above-ground pests and rootworms.

- Optimum Intrasect XTRA (events TC1507, MON810, and DAS59122-7, cry proteins Cry1F, Cry1Ab, and Cry34/35Ab1).
- YieldGard VT Triple (events MON810 and MON88017, cry proteins Cry1Ab and Cry3Bb1).
- Agrisure CB/LL/RW (events Bt11 and MIR604, cry proteins Cry1Ab and mCry3A).
- Agrisure 3000 GT, Agrisure Artesian 3011A (events Bt11, and MIR604, cry proteins Cry1Ab and mCry3A).
- Agrisure Viptera 3111 (events MIR162, Bt11 and MIR604, vip protein Vip3A and cry proteins Cry1Ab and mCry3A).
- Genuity VT Triple Pro (events MON89034 and MON88017, cry proteins Cry1A.105, Cry2Ab2 and Cry3Bb1).
- Powercore (events MON89034 and TC1507, cry proteins Cry1A.105, Cry2Ab2, and Cry1F).
- SmartStax or Genuity SmartStax (events MON89034, MON88017, TC1507 and DAS59122, cry proteins Cry1A.105, Cry2Ab2, Cry3Bb, Cry1F, and Cry34/35Ab1).

These products combine the cry proteins (and efficacy) of the above-ground pest and rootworm Bt corn traits.

Refuge requirements for Bt corn for above-ground pests in Cotton Belt (**see dealers for complete refuge requirements**)

- For YieldGard Corn Borer, Agrisure GT/CB/LL, Agrisure Artesian 3010A, Herculex I: 50% of corn on a farm can be planted as Bt corn.
- Genuity VT Double Pro, Agrisure Viptera 3110, Agrisure Viptera 3220, Optimum Intrasect, Optimum Leptra, PowerCore: 20% of corn on a farm can be planted as Bt corn.
- Blocks can be internal (within Bt field) or external (in separate field within ½ mile of Bt field to maximize random mating; ¼ mile is however preferred.
- In field strips: at least 4 rows wide to reduce effect of larval movement (6 rows preferred)
- Refuge can be sprayed with any insecticide except Bt products

Refuge requirements for Bt corn for rootworms in Cotton Belt (**see dealers for complete refuge requirements**)

Bt corn for rootworm has specific regulations that differ from stalk borer Bt corn. The major difference for rootworm Bt corn is that refuges must be either adjacent to or within the Bt field, rather than within ¼ mile of the Bt field for stalk borer Bt corn. This is due to the poor flight ability of corn rootworm adults.

Refuge requirements for stacked Bt corn for above-ground pests and rootworms in Cotton Belt (**see dealers for complete refuge requirements**)

- For YieldGard VT Triple, Agrisure CB/LL/RW, Agrisure GT 3000, Agrisure Artisian 3011A: 50% of corn on a farm can be planted as Bt corn.

- Genuity VT Triple PRO, SmartStax, Genuity SmartStax, Agrisure Viptera 3111, Optimum Intrasect XTRA: 20% of corn on a farm can be planted as Bt corn.

2 options for the refuge:
    - Common rootworm/corn borer refuge
    - Discrete rootworm and corn borer refuges
- For common refuge and discrete rootworm refuge: use adjacent field, block perimeter, or in-field strip.
- For discrete corn borer refuge: separate fields can be used in addition to other refuge options.
- For shared refuge and discrete rootworm refuge: refuges must be adjacent to or within field.
- For discrete corn borer refuge: separate refuges must be within 1/2 mile (but 1/4 mile preferred).
- At least 4 rows (for discrete corn borer refuges, at least 6 rows are recommended).
- Refuge can be sprayed with any insecticide except Bt products.

Relative Efficacy of Various Bt Corn Products[1]. (IPM-0428. Alabama Cooperative Extension Service)

Product Trade Name (Abbreviation)	Bt Protein(s)	Amout of Insect Control[1]						Herbi-cde tolera-nce[5]	Required refuge in the South[6]	Event(s)
		Corn Ear-worm (ear)	Fall Army-worm (whorl)	Corn borers[2] (stalk)	Black cutworm (seed-ling)	Lesser Corn-stalk Borer[3]	Corn root-worm[4] (roots)			
		----------Above-ground----------								
Agrisure Products										
Agrisure Artesian 3010A	Cry1Ab	F	F-G	E	P	G	-	GTLL	50%	Bt11, GA21
Agrisure GT/CB/LL	Cry1Ab	F	F-G	E	P	G	-	GTLL	50%	Bt11, GA21
Agrisure 3000GT, Agrsiure Artesian 3011A	Cry1Ab, mCry3A	F	F-G	E	P	G	F-G	GT LL	50%	Bt11, MIR604, GA21
Agrisure Viptera 3110	Vip3Aa20, Cry1Ab	E	E	E	G	G	-	GT LL	20%	MIR162, Bt11, GA21
Agrisure Viptera 3111	Vip3Aa20, Cry1Ab, mCry3A	E	E	E	G	G	F-G	GT LL	20%	MIR162, Bt11, MIR604, GA21
Agrisure Viptera 3220	Vip3Aa20, Cry1Ab, Cry1F	E	E	E	VG	VG	-	GT LL	20%	MIR162, Bt11, TC1507, GA21
Herculex and Optimum Products										
Herculex I (HX1) or (HR)	Cry1F	P	G-VG[7]	E	G	G	-	LL	50%	TC1507
Optimum Intrasect (YHR)	Cry1F, Cry1Ab	F-G	VG	E	VG	VG	-	LL RR2	20%	TC1507, MON810
Optimum Intrasect XTRA (YXR)	Cry1F, Cry1Ab, Cry34Ab1/Cry35Ab1	F-G	VG	E	VG	VG	E	LL RR2	20%	TC1507, MON810, DAS-59122-7
Optimum Leptra (VYHR)	Cry1F, Cry1Ab, Vip3Aa20	E	E	E	VG	VG	-	LL RR2	20%	TC1507, MON810, MIR162
YieldGard Products										
YieldGard Corn Borer (YGCB)	Cry1Ab	F	F-G	E	P	G	-	-	50%	MON810
YieldGard VT Triple (VT3)	Cry1Ab, Cry3Bb1	F	F-G	E	P	G	VG	RR2	50%	MON810, MON88017
Genuity/SmartStax Products										
Genuity VT Double PRO (GENVT2P), Genuity Drought Gard VT Double PRO (GENDGVT2P)	Cry1A.105, Cry2Ab2	G	E	E	P	VG	-	RR2	20%	MON89034, NK603
Genuity VT Triple PRO (GENVT3P)	Cry1A.105, Cry2Ab2, Cry3Bb1	G	E	E	P	VG	VG	RR2	20%	MON89034, MON88017
PowerCore (Dow)	Cry1A.105, Cry2Ab2, Cry1F	G-VG	E	E	G	VG	-	LL RR2	20%	MON89034, TC1507, NK603
SmartStax (SSX, Dow) or Genuity SmartStax (GENSS, Monsanto)	Cry1A.105, Cry2Ab2, Cry1F, Cry3Bb1, Cry34Ab1/Cry35Ab1	G-VG	E	E	G	VG	E	LL RR2	20%	MON89034, TC1507, MON88017, DAS-59122-7

[1] E = excellent, VG = very good, G = good, F = fair, P = poor. Excellent usually means better than 95 percent control. Poor means less than about 30% control. [2] Southwestern corn borer, European corn borer, and sugarcane borer, and others. [3] Lepidopteran Bt traits do not specifically list lesser cornstalk borer (LCB) as a target pest. [4] Bt rootwom traits target western corn rootworm larvae (CRW), which occurs in areas such as north Alabama and north Georgia. These traits are not effective against southern corn rootworm. [5] GT = Glyphosate tolerant; LL= Liberty Link (glufosinate tolerant); RR2= Roundup Ready 2 (glyphosate tolerant) [6] See product Insect Resistance Management (IRM) documentation from the seed companies for more details. [7] Resistance to Cry1F has been reported in some areas of the Southeast. Adapted from D. Buntin and K. Flanders, 2014, Bt Corn Products for the Southeastern United States. Based on input from entomologists attending the annual Southern Field Crops Management Seminar.

INSECTICIDES AT PLANTING

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworm (fall armyworm) 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Billbugs (seed treatment)	Clothianidin PONCHO 1250 or ACCELERON	1.25 mg (ai)/seed	-	-	-	Seed treatment
	Thiomethoxam CRUISER 5FS 1250	1.25 mg (ai)/seed	12	-	-	Seed treatment
Billbugs (at planting insecticide)	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Chinch bug (seed treatment) 	Clothianidin PONCHO 250 or ACCELERON PONCHO 1250 or ACCELERON	0.25 mg (ai)/seed 1.25 mg (ai)/seed	- -	- -	- -	Seed treatment
	Thiomethoxam CRUISER 5FS 250 CRUISER 5FS 1250	0.25 mg (ai)/seed 1.25 mg (ai)/seed	12 12	- -	- -	Seed treatment
Chinch bug (at planting insecticide)	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R LORSBAN 15G	1-2 pts/acre 1-2 pts/acre 8 oz/1000 ft of row.	24 24 24	21 21 21	21 21 21	Apply as preplant broadcast granules or a preplant broadcast spray in 20 gal spray/ac or more.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Chinch bug (at planting insecticide) (*cont.*)	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Corn earworm 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Cutworm 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Cutworm (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.15-0.30 oz/ 1000 ft of row	12	30	30	
	CAPTURE 1.15G R	6.4-8 oz/ 1000 ft	12	30	30	
	Chlorpyrifos LORSBAN 4E R	1-2 pts/acre	24	21	21	Apply as preplant broadcast granules or a preplant broadcast spray in 20 gal spray/ac or more.
	CHLORPYRIFOS 4E AG R	1-2 pts/acre	24	21	21	
	LORSBAN 15G	8 oz/1000 ft of row	24	21	21	
	Esfenvalerate ASANA XL R	0.45 oz/ 1000 ft of row	12	21	-	Apply in band, T-band, or in furrow.
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in band, T-band, or in furrow.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in band, T-band, or in furrow
	Permethrin PERMETHRIN 3.2EC R	4-8 oz/ac *or* 0.3-0.6 oz/ 1000 ft of row.	12	30	0 (green) 30 (fodder)	Apply in band, T-band, or in furrow
	POUNCE 25 WP R	6.4-9.6 oz/ac *or* 0.5-0.75 oz/1000 ft of row	12	30	0 (green) 30 (fodder)	

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Cutworm (at planting insecticide) (*cont.*)	Permethrin POUNCE 1.5G R	8 oz/1000 ft of row	12	30	0 (green) 30 (fodder)	Apply in band, T-band, or in furrow
	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow. *Suppression only.*
	Zeta-cypermethrin MUSTANG MAX R	0.16 oz /1000 ft of row	12	30	60	
European corn borer 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Lesser corn stalk borer 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn. Herculex I, Herculex Xtra, and Genuity Smartstax provide good-excellent control; other Bt products will provide poor-good control.
Lesser corn stalk borer (at planting insecticide)	Chlorpyrifos LORSBAN 4E R	2 pts/acre	24	21	21	Apply as preplant broadcast granules or a preplant broadcast spray in 20 gal spray/ac or more.
	CHLORPYRIFOS 4E AG R	2 pts/acre	24	21	21	
	LORSBAN 15G	8 oz/1000 ft of row	24	21	21	
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow. *Supression only.*

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Lesser corn stalk borer (at planting insecticide) (*cont.*)	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Wireworm (seed treatment)	Clothianidin PONCHO 250 or ACCELERON PONCHO 1250 or ACCELERON	 0.25 mg (ai)/seed 1.25 mg (ai)/seed	 - -	 - -	 - -	Seed treatment
	Thiomethoxam CRUISER 5FS 250 CRUISER 5FS 1250	 0.25 mg (ai)/seed 1.25 mg (ai)/seed	 12 12	 - -	 - -	Seed treatment.
Wireworm (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.15-0.30 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Or in furrow.
	Bifenthrin CAPTURE 1.15G R CAPTURE 1.15G R	6.4-8 oz/ 1000 ft of row 3.2-8 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Apply in furrow.
	Chlorpyrifos LORSBAN 15G	8 oz/ 1000 ft of row	24	21	21	Apply in T-band or in furrow.
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac. *Suppression only*.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Permethrin PERMETHRIN 3.2EC R	0.3 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	Apply in furrow, band or T-band using at least a 4 inch band.
	Permethrin POUNCE 1.5G R	8 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Wireworm (at planting insecticide) (*cont.*)	Terbufos COUNTER 15G R	6 to 8 oz/1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Seed corn maggot (seed treatment) 	Clothianidin PONCHO 250 or ACCELERON PONCHO 1250 or ACCELERON	 0.25 mg (ai)/seed 1.25 mg (ai)/seed	 - -	 - -	 - -	Seed treatment
	Thiomethoxam CRUISER 5FS 250 CRUISER 5FS 1250	 0.25 mg (ai)/seed 1.25 mg (ai)/seed	 12 12	 - -	 - -	Seed treatment.
Seed corn maggot (at planting insecticide)	Bifenthrin CAPTURE 2EC R CAPTURE 1.15G R	0.15-0.30 oz/ 1000 ft of row 6.4-8 oz/ 1000 ft of row 3.2-8 oz/ 1000 ft of row	12 12	30 30	30 30	Apply in 5-7 inch T-band. Or in furrow. Apply in 5-7 inch T-band. Apply in furrow.
	Chlorpyrifos LORSBAN 15G	8 oz/ 1000 ft of row	24	21	21	Apply in T-band or in furrow.
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Permethrin PERMETHRIN 3.2EC R POUNCE 3.2EC R	0.3 oz/ 1000 ft of row 0.3 oz/ 1000 ft of row	12 12	30 30	0 (green) 30 (fodder) 0 (green) 30 (fodder)	Apply in furrow, band or T-band using at least a 4 inch band.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Seed corn maggot (at planting insecticide) (*cont.*)	Permethrin PERMETHRIN 3.2EC R POUNCE 3.2EC R	0.3 oz/ 1000 ft of row 0.3 oz/ 1000 ft of row	12 12	30 30	0 (green) 30 (fodder) 0 (green) 30 (fodder)	Apply in furrow, band or T-band using at least a 4 inch band.
	Permethrin POUNCE 1.5G R	8 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.
	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Southern corn rootworm larvae (seed treatment)	Clothianidin PONCHO 250 or ACCELERON PONCHO 1250 or ACCELERON	0.25 mg (ai)/seed 1.25 mg (ai)/seed	- -	- -	- -	Seed treatment
	Thiomethoxam CRUISER 5FS 250 CRUISER 5FS 1250	0.25 mg (ai)/seed 1.25 mg (ai)/seed	12 12	- -	- -	Seed treatment.
Southern corn rootworm larvae (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.30 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Or in furrow.
	Bifenthrin CAPTURE 1.15G R	6.4-8 oz/ 1000 ft of row 3.2-8 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Apply in furrow.
	Chlorpyrifos LORSBAN 15G	8 oz/ 1000 ft of row	24	21	21	Apply in T-band or in furrow.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Southern corn rootworm larvae (at planting insecticide) (*cont.*)	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.
	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

POST EMERGENCE INSECTICIDES

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworms 	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground. Apply broadcast when insects first appear.
	CAPTURE 1.15G R	3.5-8.7 oz /ac	12	30	30	
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb/ ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Chlorpyrifos LORSBAN 4E R	1-2 pts /acre	24	21	21	
	CHLORPYRIFOS 4E AG R	1-2 pts /acre	24	21	21	
	Chloroantraniliprole PREVATHON	14-20 oz /ac	4	14	-	
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ ac	12	21	-	
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	For control of 1st and 2nd instars only.
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	Use higher rates for large larvae.
	Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	21 (ears)	3 (green) 21 (fodder)	
	LANNATE SP R	0.25-0.5 lbs/ac	48	21 (ears)	3 (green) 21 (fodder)	

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworms (*cont.*)	Methoxyfenozide INTREPID 2F	4-16 oz/ac	4	21	21	Use only for true armyworm. Apply at first sign of egg hatch.
	Permethrin PERMETHRIN 3.2EC R POUNCE 25 WG R	4-6 oz/ac 6.4-9.6 oz/ac	12 12	30 30	0 (green) 30 (fodder) 0 (green) 30 (fodder)	Apply at first sign of egg hatch.
	Permethrin POUNCE 1.5G R	6.7-13.3 oz /ac	12	30	0 (green) 30 (fodder)	Apply at first sign of egg hatch.
	Spinosad TRACER BLACKHAWK	2-3 oz/ac 1.1-3.3	4 4	28 28	1 (grain) 3 (fodder)	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	3.2-4.0 oz /ac	12	30	60	
Chinch bug 	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb /ac 1-2 qts/ac	12 12	14 (silage) 48 (ears) 14 (silage) 48 (ears)	14 (green) 48 (fodder) 14 (green) 48 (fodder)	Use ground equipment to apply at least 20 gal/ac of water and direct spray towards stalk
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	1-2 pts /acre 1-2 pts /acre	24 24	21 21	21 21	
	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Chinch bug (*cont.*)	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	0 (green) 12 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	Spray needs to be directed towards base of plant.
	Gamma-cyhalothrin PROAXIS R	3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	3.2-4.0 oz /ac	12	30	60	
Corn earworm 	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz/ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Chlorpyrifos LORSBAN 4E R	1.5-2 pts /acre	24	21	21	
	CHLORPYRIFOS 4E AG R	1.5-2 pts /ac	24	21	21	
	Chloroantraniliprole PREVATHON	14-20 oz /ac	4	14		
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz/ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	Spray needs to be directed towards base of plant.
	Gamma-cyhalothrin PROAXIS R	1.92-3.2 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
	Lambda-cyhalothrin WARRIOR R	1.92-3.2 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
Corn earworm (*cont.*) 	Methomyl LANNATE LV R LANNATE SP R	 0.75-1.5 pts /ac 0.25-0.5 lbs /ac	 48 48	 21 (ears) 21 (ears)	 3 (green) 21 (fodder) 3 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R POUNCE 25 WG R	 4-6 oz/ac 6.4-9.6 oz/ac	 12 12	 30 30	 0 (green) 30 (fodder) 0 (green) 30 (fodder)	Apply just before silking.
	Spinosad TRACER BLACKHAWK	 2-3 oz/ac 2.2-3.3	 4 4	 28 28	 1 (grain) 3 (fodder)	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz /ac	12	30	60	
Cutworm	Beta-cyfluthrin BAYTHROID XL R	0.8-1.6 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	 2.5 lb/ac 2 qts/ac	 12 12	 14 (silage) 48 (ears) 14 (silage) 48 (ears)	 14 (green) 48 (fodder) 14 (green) 48 (fodder)	Apply in 12-inch band over the row using sufficient volume of water to obtain thorough coverage. For broadcast, use at least 20 gal/ac of water by ground
	Deltamethrin DELTA GOLD 1.5EC R	1-1.5 oz/ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Cutworm (*cont.*)	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	
	Gamma-cyhalothrin PROAXIS R	1.92-3.20 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	1.92-3.20 oz/ac	24	21	1 (green) 21 (fodder)	
	Methomyl LANNATE LV R LANNATE SP R	1.5 pts/ac 0.5 lbs/ac	48 48	21 (ears) 21 (ears)	3 (green) 21 (fodder) 3 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R POUNCE 25 WG R	4-6 oz/ac 6.4-9.6 oz/ac	12 12	30 30	0 (green) 30 (fodder) 0 (green) 30 (fodder)	
	Permethrin POUNCE 1.5G R	6.7-13.3 oz/ac	12	30	0 (green) 30 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	1.28-2.8 oz /ac	12	30	60	
European corn borer	Bifenthrin CAPTURE 2EC R CAPTURE 1.15G R	2.1-6.4 oz /ac 3.5-8.7 oz /ac	12 12	30 30	30 30	Apply broadcast in at least 10 gal/ac of water by ground. Apply broadcast at or just before egg hatch.
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.875-2.5 lb/ac 1.5-2 qts /ac	12 12	14 (silage) 48 (ears) 14 (silage) 48 (ears)	14 (green) 48 (fodder) 14 (green) 48 (fodder)	Use ground equipment to apply at least 15 gal/acre of water and direct spray towards stalk.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
European corn borer (*cont.*)	Chlorpyrifos LORSBAN 4E R	1-2 pts/ac	24	21	21	
	CHLORPYRIFOS 4E AG R	1-2 pts/ac	24	21	21	
	LORSBAN 15G *1st generation*	3.5-8 oz/ 1000 ft of row	24	21	21	
	2nd generation	6-8 oz/ 1000 ft of row	24	21	21	
	Chloroantraniliprole PREVATHON	14-20 oz /ac	4	14		
	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	Application must be made before larvae enter plant.
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	7.8-9.6 oz /ac	12	21	-	Spray when eggs are in blackhead stage or before larvae enter whorl.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
	Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	21 (ears)	3 (green) 21 (fodder)	
	LANNATE SP R	0.25-0.5 lbs/ac	48	21 (ears)	3 (green) 21 (fodder)	
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
European corn borer (*cont.*)	Methoxyfenozide INTREPID 2F	4-16 oz/ac	4	21	21	Apply at first sign of egg hatch. Direct application at whorl for early season (1st generation). Apply as broadcast over row mid and late season.
	Permethrin PERMETHRIN 3.2EC R POUNCE 25 WG R	4-6 oz/ac 6.4-9.6 oz/ac	12 12	30 30	0 (green) 30 (fodder) 0 (green) 30 (fodder)	
	Permethrin POUNCE 1.5G R	6.7-13.3 oz /ac	12	30	0 (green) 30 (fodder)	
	Spinosad TRACER BLACKHAWK	1-3 oz/ac 1.1-3.3	4 4	28 28	7	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	
Flea beetle 	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb /ac 1-2 qts/ac	12 12	14 (silage) 48 (ears) 14 (silage) 48 (ears)	14 (green) 48 (fodder) 14 (green) 48 (fodder)	
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	1-2 pts /acre 1-2 pts /acre	24 24	21 21	21 21	
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Flea beetle (*cont.*)	Beta-cyfluthrin BAYTHROID XL R	0.8-1.6 oz /ac	12	21	0 (green) 21 (fodder)	
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz/ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R POUNCE 25 WG R	 4-6 oz/ac 6.4-9.6 oz/ac	 12 12	 30 30	 0 (green) 30 (fodder) 0 (green) 30 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	
Grasshoppers 	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	 0.5-1 pts /acre 0.5-1 pts /acre	 24 24	 21 21	 21 21	
	Beta-cyfluthrin BAYTHROID XL R	2.1-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Grasshoppers (*cont.)* 	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz /ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	For 1st and 2nd instar nymph, use 3.9-5.8 oz/ac. Timing and good coverage is critical. Beyond 2nd instar, use 5.8-9.6 oz/ac
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	
Lesser cornstalk borer 	Chlorpyrifos LORSBAN 4E R	2 pts /acre	24	21	21	Apply as broadcast spray in at least 15 gal/ac for ground equipment.
	CHLORPYRIFOS 4E AG R	2 pts /acre	24	21	21	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
Southern corn rootworm beetles	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Southern corn rootworm beetles (*cont.*) 	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	Use at least 5 gal/ac for ground application.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	Apply at first sign of silk feeding.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	21 (ears)	3 (green) 21 (fodder)	
	LANNATE SP R	0.25-0.5 lbs/ac	48	21 (ears)	3 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R	4-6 oz/ac	12	30	0 (green) 30 (fodder)	
	POUNCE 25 WG R	6.4-9.6 oz/ac	12	30	0 (green) 30 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	3.2-4.0 oz /ac	12	30	60	Use at least 10 gal/ac for ground application.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Stink bugs 	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast.
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	Use at least 5 gal/ac for ground application.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	Use at least 10 gal/ac for ground application.
PRE-MIXED or CO-PACKAGED INSECTICIDES						
BRAND NAME		**RATE**	**REI**	**PHI**	**PGI**	**COMMENTS**
COBALT (chlorpyrifos, gamma-cyhalothrin)		7-42 oz/ac	24	32	1 (green) 21 (fodder)	
HERO (Bifenthrin, zeta-cypermethrin)		2.6-10.3 oz/ac	12	30	30 (green) 60 (forage)	
BESIEGE (lambda-cyhalothrin, clorantraniliprole)		5-10 oz/ac	24	21	1 (green) 21 (fodder)	

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

WEED CONTROL IN COTTON

Mike Marshall, Extension Weed Specialist

Preplant Burndown Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.0-2.0 fl oz	0.016-0.032 lb	14	3 days	12 hours

Aim 1.9EW

Comments : Apply any time prior to planting. For best results, apply to weeds that are less than 4 inches tall (less than 3 inch rosettes). Use higher rate for treating larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution, or MSO (1-2 gal per 100 gals of spray solution). Add 2,4-D LVE to improve control of cutleaf eveningprimrose and wild radish. Tank mix partners include GLYPHOSATE, LIBERTY, GRAMOXONE, 2,4-D LVE, or CLARITY. **Rainfast interval = 6-8 hours.**

Brake F16 2.7 SC (*fluridone* + *fomesafen*)	16 fl oz	0.15 lb + 0.1875 lb	12 14	None	24 hours

Comments: Apply BRAKE F16 up to 14 days before planting cotton. Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*). Do not apply more than 16 fl oz per acre per season. Do not apply by air or through an irrigation system. Dry weather following application of BRAKE F16 will reduce its effectiveness on Palmer amaranth. Tank mix Brake F16 with glyphosate and 2,4-D for control of existing weeds prior to planting. Follow up BRAKE F16 with a residual herbicide program at planting.

Clarity 4S (*dicamba*)	8.0 fl oz	0.25 lb	4	7 days	24 hours

Comments: Excellent control of most winter annual broadleaf weeds. Following application of CLARITY and at least 1 inch rainfall, a waiting period of at least 21 days is required before cotton planting. In general, CLARITY is less effective than 2,4-D LVE on cutleaf eveningprimrose control. **Rainfast interval = 4 hours.**

Direx 4L (*diuron*)	1.5-2.0 pt	0.75-1.0 lb	7	7 days	12 hours

Comments: Apply in a minimum of 10 GPA of water per acre. Controls winter annual weeds (up to 2" in size) and provides some residual control into the early growing season. Must be applied 15 to 150 days prior to cotton planting. Add a compatibility agent to the spray tank when tank mixing with GLYPHOSATE. Do not apply where soil-applied organophosphate insecticide was used as severe crop injury will occur. Do not apply to sandy or sandy loam soils with organic matter less than 1.0%. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

ET 0.208 EC (*pyraflufen ethyl*)	0.5-2.0 oz	0.0008-0.003 lb	14	---	12 hours

Comments: Cotton may be planted any time after ET application. For best result, apply ET to broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter. Do not apply more than 2.0 oz/A for burndown. Add a suitable adjuvant like NIS at 1.0% v/v (1 gal per 100 gal of spray solution) will optimize weed control. Ground application requires minimum of 10 gallons/A. Do not allow livestock to graze in treated areas. **Rainfast interval = 1 hour.**

Preplant Burndown Herbicides for Weed Management in Cotton (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Flexstar GT 3.5 2.82EC (*fomesafen* + *glyphosate*)	3.5-5.3 pt	0.25-0.37 lb + 0.99-1.50 lb ae	14 + 9	70 days	24 hours

Comments: Apply FLEXSTAR GT 7-14 days before planting. Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*) that has not emerged from the soil. Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Adequate rainfall or irrigation (around 0.25") within 7 days of application is required for activation. Some crinkling or spotting of cotton foliage or stunting may occur, especially if heavy rainfall occurs during or soon after emergence, but plants outgrow these effects and develop normally. Tank mix with COTORAN, DIREX, PROWL, or STAPLE to broaden the spectrum of weed control. **Rainfast interval = heavy rainfall shortly after application may reduce effectiveness.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

FirstShot 50 SG	0.5-0.8 oz			---	12 hours
(*thifensulfuron* + *tribenuron*)		0.125-0.20 lb + 0.125 + 0.20 lb	2 + 2		

Comments: Apply 14 days before planting cotton. If applying to light-textured soils, such as sands, loamy sands, and sandy loams, wait an additional 7 days to plant. Add COC at 1 gal per 100 gals or NIS at 2 pt per 100 gal of spray solution plus nitrogen fertilizer (UAN at 2 qt/A or AMS at 2 lb/A). FIRSTSHOT may be tank mixed with 2,4-D LVE (for improved control of cutleaf eveningprimrose, henbit, and Carolina geranium), GLYPHOSATE, CLARITY, LIBERTY, or GRAMOXONE. If tank mixing with 2,4-D LVE, observe the more restrictive waiting interval to plant (14-30 days, depending on rate, see 2,4-D LVE section). **Rainfast interval = 2 hours.**

Glyphosate acid equivalent (ae)				7 days	4 hours
4.5 lb ae/gal	22-32 fl oz	0.75-1.13 lb ae	9		

Comments: Apply in a minimum of 10 GPA of water per acre 14-30 days prior to cotton planting. Controls henbit, ryegrass, cutleaf evening primrose and wild radish (*although not as effective as glyphosate + 2,4-D LVE*). 2,4-D or CLARITY can be added to this mixture. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Goal 2XL (*oxyfluorfen*)	1.0-2.0 pt	0.25-0.5 lb	14	75 days	24 hours

Comments: Apply GOAL 2XL a minimum of 7 days before planting cotton. Tank mix with GLYPHOSATE or PARAQUAT for control of larger winter annual broadleaf weeds or annual grasses in fallow beds (fall or late winter/early spring burndown). Provides postemergence and soil residual control of horseweed, pigweeds, and henbit.

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Preplant Burndown Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL 2S (*paraquat*)	2.0-4.0 pt	0.5-1.0 lb	22	7 days	12 hours
paraquat 3S	1.5-2.0 pt				
Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Apply in a minimum of 10 GPA at planting. Controls seedling *glyphosate- and ALS-resistant Palmer amaranth* that have emerged since the early preplant burndown treatment. Add NIS at 1 qt/100 gal of spray mix. **Rainfast interval = 30 minutes.**					
Leadoff 33.4 DF	1.5 oz			30 days	4 hours
(*rimsulfuron*		0.0157 lb	2		
+					
thifensufluron)		0.0157 lb	2		
Comments: Apply LEADOFF 30 days or more prior to planting cotton. LEADOFF tank mix partners include GLYPHOSATE, PARAQUAT, 2,4-D LVE, DICAMBA, or GLUFOSINATE. No additional surfactant is needed if tank mixed with glyphosate or glufosinate with a built-in adjuvant system. Otherwise, add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal of spray solution plus an ammonium nitrogen fertilizer (AMS at 2 lb/A or UAN at 2 qt/A).					
Liberty 280 SL (*glufosinate*)	29-43 oz	0.53-0.79 lb	10	70 days	12 hours
Interline 2.34SL					
Comments: Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. Best results obtained when daytime temps exceed 75 F. Consult label for maximum season application rates for LIBERTY (burndown + in-season applications). **Rainfast interval = 4 hours.**					
Prowl 3.3EC (*pendimethalin*)	1.8-3.6 pt	0.75-1.5 lb	3	60 days	24 hours
Comments: Apply in a minimum of 10 GPA of water per acre. Apply PROWL up to 15 days before planting. PROWL must be activated by rainfall or irrigation, preferably within 2 days. For best results, apply to weeds that are less than 4" tall (less than 3" rosettes). Use higher rate for treating larger weeds. Dense weed or cover crop stands will reduce the effectiveness of residual weed control. Add 2,4-D LVE to improve control of cutleaf eveningprimrose and Carolina geranium.					
Resource 0.86EC (*fumiclorac*)	2.0-4.0 fl oz	0.013-0.026 lb	14	7 days	12 hours
Comments: Apply in a minimum of 10 GPA of water per acre any time prior to planting. For best results, apply to weeds that are less than 4" tall (less than 3" rosettes). Use higher rate for treating larger weeds. Add a COC (1-2 gal/100 gals), NIS (1 qt/100 gals), or MSO (1-2 gal/100 gals). Add 2,4-D LVE to improve control of cutleaf eveningprimrose. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**					

Preplant Burndown Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Sharpen 2.85SC (*saflufenacil*)	1.0 fl oz	0.022 lb	14	80 days	12 hours

Comments: Apply SHARPEN a minimum of **42 days** plus the accumulation of **1.0 inch of rainfall or irrigation** before planting cotton. Add COC at 1 gal per 100 gal or MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 2 qt/A or AMS at 2 lb/A). If tank mixing with GLYPHOSATE, AMS is recommended. Do not apply SHARPEN with other group 14 (PPO inhibitors) products (i.e., VALOR OR REFLEX) as a tank mix or as a sequential application within 30 days or crop injury may result. Do not apply to coarse soils classified as SAND with less than 1.5% organic matter or cotton injury may result. Tank mix partners include CLARITY, DISTINCT, GLYPHOSATE, and PROWL H2O. **Rainfast interval = 1 hour.**

Valor 51WDG (*flumioxazin*)	2.0 oz	0.063 lb	14	21 days	12 hours
Valor EZ 4SC	2.0 fl oz				

Comments: Apply in a minimum of 10 GPA of water per acre 14-30 days prior to cotton planting. Controls cutleaf evening primrose and wild radish (*although not as effective as glyphosate + 2,4-D LVE*) and provides 2-4 weeks of residual control of weeds such as *glyphosate- and ALS-resistant Palmer amaranth*. 2,4-D or CLARITY may be tank mixed with this mixture*. Be sure to follow the clean-out instructions for removing VALOR from the sprayer after each day's use;* ***do not let VALOR sit overnight in the tank***. See below for preplant burndown waiting intervals prior to cotton planting (Assumes 2.0 oz/A of Valor SX):

Ground Residue Amounts	Cotton Plant-Back Intervals (days before planting)	
	Strip-Till Before Valor SX	Strip-Till following Valor SX
<30 % residue cover	28 days	7 days
>30 % residue cover	21 days	7 days

Resistance Management: *Make only* ***one*** *application of a group 14 containing herbicide per growing season.*

Warrant 3.0ME (*acetochlor*)	1.25-2.0 qt	0.94-1.5 lb	15	---	12 hours

Comments: Apply WARRANT any time prior to planting but before weeds germinate. Provides residual control of small seeded broadleaves and grasses. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control exisiting weeds. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

At-Plant Postemergence Broadcast for Glyphosate-Resistant Palmer Amaranth

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL 2S (*paraquat*)	2.0-4.0 pt	0.5-1.0 lb	22	7 days	12 hours
paraquat 3S	1.5-2.0 pt				

Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply PARAQUAT broadcast or in a band behind the planter furrow alone in a minimum of 10 GPA at planting or after planting (before cotton emerges) tank mixed with residual herbicides, such as REFLEX, DIURON, WARRANT, and/or PROWL H2O. Controls seedling *glyphosate- and ALS-resistant Palmer amaranth* that have emerged from an earlier preplant burndown application. Increase the rate of PARAQUAT and spray volume if weeds are dense or have significant size (greater than 4 inches). Add NIS at 1 qt/100 gal of spray mix. **Rainfast interval = 30 minutes.**

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Conservation Tillage Cotton[1]

	Aim/ET[2]	Glyphosate[2]	Glyphosate + 2,4-D[2]	Glyphosate + Direx[2]	Glyphosate + Leadoff[2]	Glyphosate + Sharpen[2]	Glyphosate + Valor SX[2]	Gramoxone[2]	Gramoxone + 2,4-D[2]	Gramoxone + Clarity[2]	Gramoxone + Valor SX[2]	Gramoxone + Direx[2]	Liberty[2]
barley, little	F	E	E	E	E	E	E	G	G	G	G	G	G
bluegrass, annual	G	F	F	E	E	E	E	G	G	G	G	G	P
buttercups	G	E	E	E	E	E	E	E	E	E	E	E	E
chickweed, common	G	F	G	GE	E	E	E	E	E	GE	E	E	E
clovers	P	PF	F	F	G	E	F	G	G	GE	GE	GE	F
cudweed	G	E	E	E	E	E	E	FG	FG	FG	FG	FG	G
dandelion	P	P	E	GE	E	G	G	N	E	GE	P	GE	FG
dock, curly	P	PF	G	F	F	F	G	F	FG	GE	P	F	G
eveningprimrose, cutleaf	GE	PF	E	GE	E	E	FG	F	E	GE	E	GE	G
geranium, Carolina	GE	FG	E	GE	E	E	E	GE	E	GE	E	E	GE
henbit/deadnettle	G	F	G	E	E	E	E	G	GE	E	E	GE	G
horseweed (marestail)	G	E	GE	E	GE	E	GE	F	GE	E	GE	GE	GE
mustard, wild	G	FG	E	GE	G	E	GE	FG	E	G	GE	G	GE
pansy, field	G	F	F	G	---	E	F	G	G	G	G	GE	G
peanut, volunteer	F	F	F	F	P	GE	FG	P	F	GE	F	F	GE
pepperweed, Virginia	G	G	E	GE	E	E	G	G	GE	G	G	GE	G
radish, wild	G	FG	GE	GE	G	E	GE	G	GE	GE	GE	GE	GE
ryegrass, Italian	F	G	F	FG	E	E	G	FG	FG	FG	FG	G	P
sorrel, red	F	E	E	E	G	G	E	E	E	E	E	E	PF
spurry, corn	G	GE	GE	GE	E	E	G	FG	G	G	G	G	---
swinecress	G	FG	G	G	E	E	FG	PF	FG	FG	PF	FG	GE
vetch	GE	F	E	G	E	E	FG	G	GE	GE	GE	G	GE
wheat/rye cover crop	P	E	E	G	E	E	E	FG	F	F	G	G	F

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Herbicide rates for burndown are ET at 1.0 oz/A; Aim at 2.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; Direx at 1.6 pt/A; Leadoff at 1.5 oz/A; Sharpen at 1.0 oz/A; Gramoxone at 3.0 pt/A; Valor SX at 2.0 oz/A; and Liberty at 29 oz/A.

Glyphosate-Resistant Palmer Amaranth Programs - Cotton

Palmer amaranth populations have been documented in South Carolina that are resistant to glyphosate (i.e., Roundup, Touchown), acetolactate synthase (ALS) inhibiting herbicides (i.e., Staple, Envoke) and dinitroaniline (yellow) herbicides (i.e., Prowl, Treflan, and Sonalan). The following table is designed to aid producers in managing glyphosate-resistant and ALS-resistant Palmer amaranth populations in cotton.

Overuse of PPO-inhibitors (i.e., Valor, Reflex) could lead to the development of PPO-resistant Palmer amaranth biotypes. The use of overlapping residual herbicides with postemergence herbicides will help preserve the utility of these PPO-inhibitors in the near future.

Managing Glyphosate-resistant Palmer Amaranth in Roundup Ready Flex Cotton[1]

Herbicide Program				
Preplant Burndown (PPB), Preplant Incorporate (PPI) or Preemergence (PRE)	**POST BROADCAST (1 to 4 leaf)**	**POST BROADCAST (5-6 leaf)**	**POST-DIRECTED/ LAYBY**	**HOODED**
Conventional Tillage Dryland Prowl or Treflan or Treflan + Cotoran PPI fb Reflex[2] PRE	glyphosate + Dual Magnum or Warrant *(no Palmer emerged)* OR glyphosate + Staple LX[3] *(Palmer < 2")*	glyphosate + Warrant *(no Palmer emerged)* glyphosate + Envoke[3] (*Palmer < 4"*)	Layby Pro + MSMA OR Caparol + MSMA OR Suprend + MSMA	Paraquat + Direx
Conventional Tillage Irrigated Reflex[2] + Staple LX[3] PRE *or* Reflex[2] + Direx PRE *or* Reflex[2] + Prowl PRE				
Conservation Tillage Dryland Valor[2,4] PPB followed by Direx + Warrant + Paraquat PRE *or* Valor[2,4] PPB followed by Paraquat + Reflex[2] + Direx PRE *or* Valor[2,4] PPB followed by Paraquat + Reflex[2] + Warrant PRE				
Conservation Tillage Irrigated Valor[2,4] PPB followed by Direx + Staple LX[3] + Paraquat PRE *or* Valor[2,4] PPB followed by Paraquat + Reflex[2] + Diuron PRE				

Managing Glyphosate- and ALS-resistant Palmer Amaranth in Roundup Ready Flex Cotton[1]

Herbicide Program				
Preplant Burndown (PPB), Preplant Incorporate (PPI) or Preemergence (PRE)	**POST BROADCAST (1 to 4 leaf)**	**POST BROADCAST (5-6 leaf)**	**POST-DIRECTED/ LAYBY**	**HOODED**
Conventional Tillage Dryland Prowl *or* Treflan *or* Treflan + Cotoran PPI followed by Reflex[2] + Warrant *or* Warrant + Direx PRE	glyphosate + Dual Magnum or Warrant *(no Palmer emerged)*	glyphosate + Warrant *(no Palmer emerged)*	Layby Pro + MSMA OR Caparol + MSMA OR Suprend + MSMA	Paraquat + Direx Paraquat + Caparol
Conventional Tillage Irrigated Reflex[2] + Direx PRE *or* Reflex[2] + Prowl PRE				
Conservation Tillage Dryland Valor[2,4] PPB followed by Direx + Warrant + Paraquat PRE *or* Valor[2,4] PPB followed by Paraquat + Reflex[2] + Direx PRE *or* Valor[2,4] PPB followed by Paraquat + Reflex[2] + Warrant PRE				
Conservation Tillage Irrigated Valor[2,4] PPB followed by Direx + Warrant + Paraquat PRE *or* Valor[2,4] PPB followed by Paraquat + Reflex[2] + Diuron PRE				

[1]Hand weeding, cultivation, and/or application of paraquat mixtures with hooded sprayers will likely be needed.
[2]Make only one application of Reflex or Valor during the growing season for resistance management.
[3]Make only one application of an ALS-inhibiting herbicide (Staple, Envoke, Suprend) per growing season. *Will not control ALS-resistant Palmer amaranth*.
[4]See Valor SX in the preplant burndown discussion for interval between application and planting with a strip-till planter.

Managing Glyphosate-resistant Palmer Amaranth in Liberty-Link Cotton[1]

Herbicide Program	

Preplant Burndown (PPB) or Preemergence (PRE)	POST BROADCAST (1-4 leaf)	POST DIRECTED (5-6 leaf)	LAYBY	HOODED
Conventional Tillage Reflex[2] + Direx or Prowl or Staple LX PRE or Staple LX[3] + Direx or Prowl PRE ***Conservation Tillage*** Valor[2,5] PPB followed by Paraquat + Direx + Warrant PRE or Valor[2,5] PPB followed by Paraquat + Reflex[2] + Direx PRE or Valor[2,5] PPB followed by Paraquat + Reflex[2] + Warrant PRE	Liberty[4] + Dual Magnum OR Warrant *(Palmer < 4")* OR Liberty[4] + Staple LX[3] *(Palmer < 4")*	Liberty[4] + Warrant (Palmer < 4")	Layby Pro + MSMA OR diuron + Valor[2] + MSMA OR diuron + MSMA	

[1]Hand weeding, cultivation, and/or application of paraquat mixtures with hooded sprayers will likely be needed.
[2]Make only one application of Reflex or Valor throughout the growing season for resistance management.
[3]Make only one application of an ALS-inhibiting herbicide (Staple, Envoke, Suprend) per growing season. *Will not control ALS-resistant Palmer amaranth*.
[4]Liberty will not consistently control Palmer amaranth larger than 4" tall.
[5]See Valor SX in the preplant burndown discussion for interval between application and planting with a strip-till planter.

Weed Response to Soil Applied Cotton Herbicides[1]

	PREPLANT INCORPORATED		PREEMERGENCE							
	Prowl	**Treflan**	**Brake F16**	**Command**	**Cotoran**	**Direx**	**Prowl**	**Reflex**	**Staple LX**	**Warrant**
anoda, spurred	P	P	---	GE	F	F	P	---	E	---
barnyardgrass	E	E	E	E	G	G	G	P	FG	GE
beggarweed, Florida	P	P	---	FG	GE	G	P	P	G	P
bermudagrass	P	P	P	PF	P	P	P	P	P	P
citronmelon	P	P	P	P	FG	F	P	P	FG	P
cocklebur, common	P	P	P	F	GE	P	P	G	P	P
cowpea	P	P	P	P	P	P	P	P	FG	P
crabgrass	E	E	E	E	FG	FG	G	FG	P	E
crotolaria, showy	P	P	P	G	G	G	P	P	FG	P
croton, tropic	P	P	G	P	G	F	P	FG	P	---
crowfootgrass	E	E	E	E	FG	FG	G	---	---	E
dayflower, Benghal	P	P	---	P	G	P	P	P	P	---
eclipta	P	P	---	G	G	G	P	GE	G	P
goosegrass	E	E	E	E	F	F	G	---	PF	E
jimsonweed	P	P	E	G	G	G	P	---	FG	P
johnsongrass, seedling	E	E	E	G	P	P	G	---	FG	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	GE	GE	E	G	E	E	G	E	FG	F
morningglory spp.	P	P	F	P	G	F	P	PF	F	P
nutsedge, purple	P	P	P	P	P	P	P	---	P	P
nutsedge, yellow	P	P	P	P	P	P	P	GE	P	F
panicum, fall	G	G	E	E	F	P	F	---	PF	E
panicum, Texas	P	P	E	G	P	P	F	F	P	PF
pigweed spp.	G	GE	E	P	GE	GE	F	E	GE	GE
ALS-resistant	G	GE	E	P	GE	GE	F	E	P	GE
DNA-resistant	P	P	E	P	GE	GE	P	E	GE	GE
poinsettia, wild	P	P	---	G	P	P	P	GE	G	P
purslane, common	E	E	E	GE	E	F	G	G	G	G
pusley, Florida	E	E	E	GE	G	F	G	P	P	GE
ragweed, common	P	P	F	GE	E	G	P	G	P	PF
redweed (chocolateweed)	P	P	F	GE	E	GE	P	G	GE	P
ryegrass, annual	E	E	E	GE	G	G	G	P	P	G
sandbur	E	E	E	G	G	G	G	---	---	FG
senna, coffee	P	P	FG	P	GE	P	P	P	G	P
sesbania, hemp	P	P	FG	G	P	P	P	P	P	P
sicklepod	P	P	FG	P	G	F	P	P	PF	P
sida, prickly	P	P	G	E	G	F	P	---	PF	P
signalgrass, broadleaf	G	G	E	E	P	P	G	FG	P	G
smartweed, Pennsylvania	P	P	FG	G	G	G	P	---	G	PF
spurge	P	P	G	P	P	F	P	G	G	F
starbur, bristly	GE	GE	F	P	GE	G	P	GE	FG	PF
velvetleaf	P	P	G	E	F	PF	P	P	E	P
vol. peanuts	P	P	P	F	P	P	P	P	P	P

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

2

Preplant Incorporated Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Prowl 3.3EC (*pendimethalin*)	1.0-2.0 pt	0.5-1.5 lb	3	21 days	24 hours
Prowl H_2O 3.8CS	2.0-4.0 pt	0.95-1.9 lb			

Comments: Apply PROWL up to 60 days before planting and incorporate. Controls annual grasses and some small-seeded broadleaf weeds, seedling johnsongrass; poor control of large-seeded broadleaf weeds (i.e., annual morningglory, cocklebur, sicklepod). For maximum pigweed control, use 2.0 pt/A application rate. Use the lower rate if a sequential application of pendimethalin is planned at planting. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Application within a week of planting is recommended.

NOTE: *If your field(s) have a history of poor Palmer amaranth control with yellow herbicides (PROWL, TREFLAN, SONALAN), a follow-up preemergence herbicide (i.e. Dual Magnum, Warrant) will be needed at planting or early postemergence.*

Treflan 4HFP (*trifluralin*)	1.0-2.0 pt	0.5-1.0 lb	3	60 days	12 hours

Comments: Controls annual grasses and some small-seeded broadleaf weeds, seedling johnsongrass; poor control of large-seeded broadleaf weeds (i.e., annual morningglory, cocklebur, sicklepod). Use 2.0 to 3.0 pt/A for rhizome johnsongrass control. For enhanced pigweed control, use 1.5 pt/A on coarse-textured soils and 2.0 pt/A on medium-textured soils. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Application within a week of planting is recommended.

NOTE: *If your field(s) have a history of poor Palmer amaranth control with yellow herbicides (PROWL, TREFLAN, SONALAN), a follow-up preemergence herbicide (i.e. DUAL MAGNUM, WARRANT) will be needed at planting or early postemergence.*

Treflan 4HFP (*trifluralin*)	1.0-2.0 pt	0.5-1.0 lb	3	90 days	12 hours
+					
Cotoran 4F (*fluometuron*)	1.0-2.0 qt	1.0-2.0 lb	7		

Comments: Controls annual grasses and broadleaf weeds, seedling johnsongrass; COTORAN improves control of large-seeded broadleaf weeds (i.e., annual morningglory, cocklebur, sicklepod). See above for soil texture and rate discussion on TREFLAN. Use lower rate of COTORAN on coarse textured soils. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Application within a week of planting is recommended.

Preemergence Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Brake F16 2.7 SC (*fluridone* + *fomesafen*)	16 fl oz	 0.15 lb + 0.1875 lb	 12 14	None	24 hours
Comments: Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*), crabgrass, prickly sida, and crowfootgrass. Apply BRAKE F16 within 36 hours of planting. Do not apply more than 16 fl oz per acre per application. Dry weather following application of BRAKE F16 will reduce its effectiveness on Palmer amaranth. Apply an early postemergence herbicide, such as *glyphosate* or LIBERTY plus a residual herbicide (i.e., DUAL MAGNUM, STAPLE, or WARRANT) within 12 to 16 days after BRAKE F16 application.					
Command 3ME (*clomazone*)	2.0-3.33 pt	 0.75-1.25 lb	 13	65 days	12 hours
Comments: Controls crabgrass, fall panicum, crowfootgrass, Texas panicum, velvetleaf, spurred anoda, and prickly sida. Provides only marginal suppression of most other broadleaf weeds (i.e., *Palmer amaranth*). May be tank mix with other herbicides to broaden weed spectrum. Do not apply COMMAND to cotton unless disulfoton or phorate organophosphate insecticide is applied in-furrow with the seed at planting time at a minimum of 0.75 lb of active ingredient per acre. Do not reduce the application rate of the organophosphate insecticide when COMMAND is applied as a band treatment. Combinations of at-planting systemic granular carbamate and organophospate insecticides applied in conjunction with COMMAND may result in injury to cotton. Crop injury may occur with higher rates of COMMAND on sandy soils. DIURON is not recommended at planting when COMMAND is used as plant injury may result. Do not apply in the air or within 1200 ft of housing developments, commercial fruit, vegetable, or nut production; or commercial ornamental nurseries or greenhouses. Do not apply more than 1.25 lb ai per acre per season. Do not allow liverstock to graze on treated cotton forage or trash, or feed treated cotton forage or trash to livestock.					
Cotoran 4F (*fluometuron*)	2.0-4.0 pt	 1.0-2.0 lb	 7	60 days	24 hours
Comments: Controls Palmer amaranth (*including ALS- and glyphosate-resistant*), sandbur, crabgrass, tropic croton, and coffee senna. Tank mix with STAPLE LX for improved control of spurred anoda and velvetleaf. For improved pigweed control, particularly in conservation tillage, REFLEX may be applied in combination with COTORAN preemergence. Cotton injury may be observed when COTORAN is applied in combination with a systemic insecticide at planting. In addition, COTORAN applied with COMMAND may result in cotton injury. Use the lower end of the rate range on lighter soils.					
Direx 4L (*diuron*)	0.8 qt	 0.8 lb	 7	90 days	12 hours
Comments: Controls Palmer amaranth (*including ALS- and glyphosate-resistant*), common ragweed, and bristly starbur. Do not apply where soil-applied organophosphate insecticide was used as severe crop injury and stand loss will occur. Seedling diseases may weaken cotton plants and increase the possibility of injury from the use of TRIFLURALIN products followed by DIREX. These treatments should only be used in conjunction with a standard fungicide seed treatment plus a supplemental soil fungicide program such as CAPTAN-PCNB mixture. Do not apply to sands or sandy loam soils with organic matter less than 1.0%.					
Flexstar GT 3.5 2.82EC (*fomesafen* + *glyphosate*)	3.5-5.3 pt	 0.25-0.37 lb + 0.99-1.50 lb ae	 14 9	70 days	24 hours
Comments: Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*) that has not emerged from the soil. Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Adequate rainfall or irrigation (around 0.25") within 7 days of application is required for activation. Some crinkling or spotting of cotton foliage or stunting may occur, especially if heavy rainfall occurs during or soon after emergence, but plants outgrow these effects and develop normally. Tank mix with COTORAN, DIREX, PROWL, or STAPLE to broaden the spectrum of weed control.					

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Preemergence Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Prowl H_2O 3.8CS (*pendimethalin*)	1.0-2.0 pt	0.48-0.95 lb	3	60 days	24 hours
Prowl 3.3EC	1.2-2.4 pt	0.50-0.99 lb			

Comments: Controls Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. Apply at planting or up to 2 days after planting.

Note: *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider tank mixing PROWL with COTORAN, REFLEX, or STAPLE.*

Reflex 2 EC (*fomesafen*)	12-16 fl oz	0.1875-0.25 lb	14	70 days	24 hours
Dawn 2 EC					

Comments: Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*). Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Adequate rainfall or irrigation within 7 days of application is required for activation. Some crinkling or spotting of cotton foliage or stunting may occur, especially if heavy rainfall occurs during or soon after cotton emergence, but plants outgrow these effects and develop normally. Tank mix with COTORAN, DIREX, PROWL, or STAPLE to broaden the spectrum of weed control.

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Staple LX 3.2SL (*pyrithiobac*)	1.7-2.1 fl oz	0.0425-0.0525 lb	2	60 days	4 hours

Comments: Controls Palmer amaranth (*glyphosate-resistant biotypes*), spurred anoda, and velvetleaf. Plant stresses from cool temps, thrips damage, or excessive soil moisture may cause temporary leaf yellowing or stunting. As conditions improve, cotton will recover. Do not use on soils where organic matter is less than 0.5% or on coarse textured soils (sands or loamy sands). Do not apply more than one preemergence application of STAPLE per year. Tank mix with PROWL for improved grass control.

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Warrant 3.0ME (*acetochlor*)	1.25-2.0 qt	0.94-1.5 lb	15	---	12 hours

Comments: Provides residual control of small seeded broadleaves and grasses. Apply after planting but before weeds germinate. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control weeds that have germinated since planting. Environmental conditions that follow application of WARRANT including cold, wet soils or water logged condition from excessive rain may result in crop injury. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Weed Response to Postemergence Broadcast Cotton Herbicides[1]

	Assure II	Cotoran	Envoke	Envoke + Staple	Fusilade DX/Fusion	Glyphosate[2]	Glyphosate+Dual Mag.[2]	Glyphosate + Envoke[2]	Glyphosate + Prowl[2]	Glyphosate + Staple[2]	Glyphosate + Warrant[2]	Liberty[3]	Liberty + Dual Mag.[3]	Liberty + Prowl[3]	Liberty + Warrant[3]	MSMA	Poast/Poast Plus	Select/Select MAX	Sequence[2]	Staple	Xtendimax[4]
anoda, spurred	P	---	P	G	P	GE	GE	E	GE	E	GE	P	P	P	P	P	P	P	GE	G	G
barnyardgrass	G	G	---	---	G	E	E	E	E	E	E	G	G	G	G	F	GE	GE	E	---	P
beggarweed, Florida	P	G	GE	GE	G	E	E	E	E	E	E	G	G	G	G	E	P	P	E	G	G
bermudagrass	G	P	P	P	G	F	F	FG	F	FG	F	P	P	P	P	P	F	G	F	P	P
citronmelon	P	G	GE	GE	P	GE	GE	E	GE	E	GE	G	G	G	G	PF	P	P	GE	---	G
cocklebur, common	P	FG	GE	G	P	E	E	E	E	E	E	E	E	E	E	E	P	P	E	G	E
cowpea	P	FG	G	GE	P	E	E	E	E	E	E	G	G	G	G	F	P	P	E	---	E
crabgrass	G	PF	P	P	G	E	E	E	E	E	E	FG	G	G	FG	F	GE	GE	E	P	P
crotolaria, showy	P	G	---	---	P	G	G	G	G	G	G	G	G	G	G	F	P	P	G	---	G
croton, tropic	P	FG	PF	PF	P	E	E	E	E	E	E	G	G	G	G	F	P	P	E	P	GE
crowfootgrass	G	PF	F	P	F	E	E	E	E	E	E	G	G	G	GE	F	FG	G	E	P	P
dayflower, Benghal	P	P	F	F	P	FG	G	G	FG	G	FG	FG	G	FG	FG	P	P	P	FG	P	P
eclipta	P	---	P	FG	P	E	E	E	E	E	E	G	G	G	G	---	P	P	E	G	G
goosegrass	G	PF	P	P	G	E	E	E	E	E	E	FG	G	G	FG	F	GE	GE	E	P	P
jimsonweed	P	G	P	GE	P	E	E	E	E	E	E	E	E	E	E	P	P	P	E	E	E
johnsongrass, seedling	E	P	FG	FG	GE	E	E	E	E	E	E	G	G	G	GE	F	GE	E	E	P	P
johnsongrass, rhizome	E	P	PF	PF	GE	GE	G	GE	E	GE	E	P	P	P	P	P	G	GE	E	P	P
lambsquarters, common	P	G	G	GE	P	G	G	E	G	G	G	E	G	G	G	P	P	P	E	P	E
morningglory spp.	P	G	G	G	P	G	G	E	G	G	G	E	E	E	E	F	P	P	G	G	E
nutsedge, purple	P	P	FG	FG	P	F	F	G	F	FG	FG	P	P	P	P	F	P	P	FG	PF	P
nutsedge, yellow	P	P	G	G	P	FG	FG	GE	FG	FG	F	P	P	P	P	FG	P	P	F	PF	P
panicum, fall	GE	PF	P	P	GE	E	E	E	E	E	E	G	G	GE	GE	F	E	E	E	P	P
panicum, Texas	G	P	P	P	G	E	E	E	E	E	E	G	G	GE	GE	P	E	E	E	P	P
pigweed spp.	P	PF	PF	F	P	E	E	G	E	E	E	G	G	G	G	P	P	P	E	G	E
glyphosate-resistant	P	PF	PF	F	P	P	P	P	P	E	P	G	G	G	G	P	P	P	P	G	E
ALS-resistant	P	PF	P	P	P	E	E	E	E	E	E	G	G	G	G	P	P	P	E	P	E
poinsettia, wild	P	F	G	G	P	G	G	E	G	GE	E	GE	GE	GE	GE	N	P	P	G	F	E
purslane, common	P	FG	---	---	P	F	F	G	F	G	F	FG	FG	FG	FG	P	P	P	G	F	---
pusley, Florida	P	PF	P	P	P	F	F	PF	FG	PF	FG	P	P	G	PF	P	P	P	FG	P	P
ragweed, common	P	G	G	G	P	E	E	E	E	E	E	E	E	E	E	P	P	P	E	FG	E
redweed (chocolateweed)	P	FG	---	---	P	G	G	G	G	G	G	E	E	E	E	P	P	P	G	---	E
ryegrass, annual	G	P	---	---	G	E	E	E	E	E	E	FG	FG	FG	FG	GE	G	G	E	---	P
sandbur, field	G	PF	---	P	G	E	E	E	E	E	E	G	G	GE	GE	F	G	G	E	P	P
senna, coffee	P	FG	---	GE	P	E	E	E	E	E	E	GE	GE	GE	GE	P	P	P	E	GE	E
sesbania, hemp	P	FG	---	GE	P	F	F	---	---	GE	---	G	G	G	G	P	P	P	---	GE	E
sicklepod	P	FG	E	E	P	GE	GE	E	GE	GE	GE	E	E	E	E	F	P	P	E	PF	E
sida, prickly	P	FG	P	F	P	E	E	G	E	G	E	G	G	G	G	P	P	P	E	F	E
signalgrass, broadleaf	G	P	P	P	GE	E	E	E	E	E	E	G	G	GE	GE	F	E	E	E	P	P
smartweed, Pennsylvania	P	FG	G	G	P	GE	GE	E	GE	E	GE	GE	GE	GE	GE	P	P	P	GE	G	E
spurge, annual	P	F	---	---	P	G	G	G	G	G	G	FG	FG	FG	FG	P	P	P	G	FG	E
starbur, bristly	P	G	GE	GE	FG	E	E	E	E	E	E	GE	GE	GE	GE	P	P	P	E	GE	E
velvetleaf	P	G	G	G	P	GE	GE	E	GE	E	GE	G	G	G	G	P	P	P	GE	G	E
vol. corn	G	P	P	P	E	E	E	E	E	E	E	F	F	F	F	P	E	GE	E	P	P
RR hybrids	G	P	P	P	E	P	P	P	P	P	P	F	F	F	F	P	E	GE	P	P	P
RR+LL hybrids	G	P	P	P	E	P	P	P	P	P	P	P	P	P	P	P	E	GE	P	P	P
vol. peanuts	P	F	PF	PF	P	F	F	F	F	F	F	GE	E	GE	GE	P	P	P	F	P	E

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.
[2]Use only on glyphosate-tolerant (Gly-Tol or Roundup Ready [RR] Flex) cotton varieties.
[3]Use only on glufosinate-tolerant (LibertyLink [LL]) cotton varieties.
[4]Use only on Bollgard II XtendFlex cotton varieties.

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Assure II 0.88E (*quizalofop*)	5-12 fl oz	0.034-0.069 lb	1	80 days	12 hours
Comments: Apply ASSURE at 7-8 oz/A over-top to control annual grasses up to 6" tall. Apply 5 oz/A to control volunteer RR-corn in cotton. For control of rhizome johnsongrass, apply 5 oz of Assure II when johnsongrass is 10-24" tall and then retreat with 5 oz when regrowth reaches 6-10" tall. For bermudagrass control, apply 10-12 oz/A at 3" tall (up to 6" runners). Add COC at 1 gal/100 gallons or 1 qt/100 gallons of spray mixture. Application intervals should be 7 days apart to allow for regrowth. Do not exceed 18 oz/A in a growing season. **Rainfast interval = 1 hour**.					
Cotoran 4L (*fluometuron*)	2.0-2.5 pt	1.0-1.25 lb	7	60 days	24 hours
Comments: Apply COTORAN to cotton after reaching 3 inches in height. Controls *glyphosate- and ALS-resistant Palmer amaranth (less than 2 inches tall)* and annual morningglory (less than 3 inches tall). Add surfactant at 2 qt/100 gal of spray solution. Tank mix partners may include MSMA, PARALLEL PCS, PYRIMAX **Rainfast interval = 2 hours.**					
Dual Mag. 7.62EC (*s-metolachlor*) Parallel PCS 8.0EC (*metolachlor*)	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours
Comments: Apply METOLACHLOR at when cotton is 3 to 6 inches tall. DUAL MAGNUM does not control emerged weeds, but will provide residual control of annual grasses, pigweeds, and suppression of yellow nutsedge. Tank mix with MSMA, GLYPHOSATE (ROUNDUP READY FLEX) or LIBERTY (LIBERTY-LINK) for control of emerged weeds. Do not apply to sand or loamy sand soils. **Rainfast interval = none**.					
Envoke 75WDG (*trifloxysulfuron*)	0.10-0.15 oz	0.0046-0.0069 lb	2	60 days	12 hours
Apply ENVOKE to 5-leaf or greater cotton for control of pigweed, annual morningglory, and yellow nutsedge. *Weak on Palmer amaranth*. Add NIS (a minimum of 80% surface active) at 1 qt/100 gal of spray solution. Do not apply with any other additive or growth regulator as unacceptable injury may occur. Tank mix with STAPLE for enhanced smallflower morningglory control. Do not apply as a preemergence as substantial cotton injury will result. **Rainfast interval = 3 hours.** **Resistance Management:** *Make only **one** application of a group 2 containing herbicide per growing season.*					
Fusilade DX 2EC (*fluazifop-p-butyl*)	8-12 fl oz	0.125-0.188 lb	1	90 days	12 hours
Comments: Controls annual and perennial grasses before they exceed 6-8" tall. For rhizome johnsongrass control, apply 12 oz/A when it is 8-18" tall. Make a second application (8 oz/A) when regrowth is 6-12" tall. For bermudagrass, apply 12 oz/A when runners are 4-8" long, and 8 oz/A when re-growth reaches 4-8". Add COC at 1 gal/100 gallon or NIS 2 pt/100 gal of spray solution. Controls volunteer RR-corn in cotton. Do not apply after boll set. Do apply more than 48 oz/A per or within 90 days of harvest. **Rainfast interval = 1 hour.**					

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Fusion 2.56EC (*fluazifop-p-butyl* + *fenoxaprop-p-ethyl*)	8-12 oz	0.16-0.24 lb	1 1	90 days	24 hours
Apply FUSION at 8 oz/A for control of most annual grasses before they exceed 6-8" tall. For rhizome johnsongrass, apply 10-12 oz/A for control of johnsongrass 8-18" tall. A second 8 oz/A treatment may be applied to control regrowth 6-12" tall. For bermudagrass, treat 4-8" runners with 12 oz/A, and then apply a second application of 8 oz/A to 4-8" re-growth. Add COC at 1 gal/100 or NIS at 2 pt/100 gallon of spray solution. Controls volunteer RR-corn in cotton. **Rainfast interval = 1 hour.**					
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22-32 fl oz	0.75-1.12 lb ae			
Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS GLY-TOL OR ROUNDUP READY FLEX! Apply GLYPHOSATE at 0.75 to 1.12 lb ae/A over-the-top from ground cracking up to 7 days before harvest. Controls annual grasses and broadleaves. In general, the first over-the-top broadcast application should be applied early to minimize weed competition (1 to 3" tall weeds). No restriction on the timing of sequential treatments. Tank mix with STAPLE, DUAL MAGNUM, or WARRANT for residual control of weeds. Aerial application rates are limited to 0.75 lb ae/A. Maximum combined total of all applications from emergence through harvest cannot exceed 4.5 lb ae/A. **Rainfast interval = 2 hours.**					
Resistance Management: *Glyphosate-resistant Palmer amaranth is spreading rapidly throughout South Carolina. Continued reliance on glyphosate-only programs will enhance selection and spread of resistant biotypes. Tank mixing glyphosate with other chemistries must be utilized. Biotypes of Palmer amaranth resistant to both ALS- and glyphosate chemistries have been confirmed in South Carolina.*					
Liberty 2.34 SL (*glufosinate*)	29-43 fl oz	0.53-0.79 lb	10	70 days	12 hours
Interline 2.34 SL					
Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS LIBERTY-LINK! Apply LIBERTY/INTERLINE in a minimum of 15 GPA using flat fan nozzles at 30-60 PSI from emergence up to the bloom growth stage. Spray coverage is essential for maximum LIBERTY/INTERLINE performance. Controls annual grasses, broadleaf weeds, and *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)*. Up to three over-the-top applications (do not exceed 36 oz/A per application) spaced apart by 10-14 days may be made, but do not exceed 87 oz/A per growing season. Add AMS at 3 lb/A to the spray solution. Tank mix with STAPLE or DUAL MAGNUM for residual weed control. Do not apply LIBERTY in conjunction with grass herbicides (i.e., SELECT, FUSILADE, or POAST). Applications of postemergence grass herbicides and LIBERTY/INTERLINE should be separated by at least 5 days. Do not graze the treated crop or cut for hay. **Rainfast interval = 4 hours.**					
Resistance Management: *Do <u>not</u> rely solely on GLUFOSINATE for complete weed control in cotton. Tank mix a residual herbicide(s) at each GLUFOSINATE application. Soil residual herbicides at burndown and at planting will help ensure optimum weed management particularly if environmental conditions delay timely sprayer operations. Residual herbicides throughtout the growing season are a key component of good weed resistance strategies*.					

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
MSMA 6.6 (*MSMA*)	2.4 pt	2.0 lb	17	--	12 hours
MSMA 6 Plus	2.66 pt				

Comments: Apply MSMA over-the-top cotton from 3-leaf (3 inches) up to early first square stage (about 6 inch cotton), whichever comes first using ground equipment. Slight burning and a reddish coloration of the cotton leaves may occur following application, but plant will develop normally. Only one application is allowed per season (at 2 lb ai/A), except where a salvage operation is needed (i.e., Palmer amaranth escapes the first application). A second repeat salvage treatment should be timed 1 to 3 weeks after first application. Do not make more than two applications per season with a seasonal maximum of 4 lb ai per acre per season. Do not apply within 50 ft of permanent water bodies or aquatic habitat including, but not limited to lakes, reservoirs, rivers, streams, marshes, ponds, and estuaries. Apply only when conditions do not favor drift onto adjacent crops. Do not feed foliage to livestock or graze treated areas. Do not apply after first bloom.

Poast 1.5E (*sethoxydim*)	1.0-1.5 pt	0.19-0.28 lb	1	75 days	12 hours
Poast Plus 1E	1.5-2.25 pt				

Comments: Apply POAST/POAST PLUS anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A (2.25 pt/A POAST PLUS) up to 25" tall. A second 1.0 pt/A (1.5 pt/A POAST PLUS) treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A (2.25 pt/A POAST PLUS), and then apply a second application of 1.0 pt/A (1.5 pt/A POAST PLUS) to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or COC 2 pt/A. Include UAN at 4-8 pt/A or AMS at 2.5 lb/A for enhanced crabgrass activity. Consult label for tank mix partners. Controls volunteer corn in cotton. **Rainfast interval = 1 hour.**

Prowl H_2O 3.8CS (*pendimethalin*)	1.0-2.0 pt	0.48-0.95 lb	3	60 days	24 hours
Prowl 3.3EC	1.2-2.4 pt	0.50-0.99 lb			

Comments: Apply PROWL broadcast postemergence over the top after cotton reaches the 4- to 5-leaf stage of growth, but not after the 8-leaf stage of growth. Over the top applications made before the 4-leaf stage or after the 8-leaf stage of development may result in crop injury and/or yield loss. If a timely irrigation follows or rain occurs after application, PROWL provides residual control of Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. Postemergence applications of PROWL may cause temporary growth reduction and/or leaf discoloration or malformation of cotton following application.

Note: *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider an alternative postemergence residual herbicide, such as WARRANT or DUAL MAGNUM.*

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Prowl H_2O 3.8CS (*pendimethalin*)	1.0-2.0 pt	0.48-0.95 lb	3	60 days	24 hours
Prowl 3.3EC	1.2-2.4 pt	0.50-0.99 lb			
+					
Glyphosate acid equivalent (ae)	22-32 fl oz		9		
4.5 lb ae/gal		0.75-1.12 lb ae			

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! Apply PROWL broadcast postemergence over the top after cotton reaches the 4- to 5-leaf stage of growth, but not after the 8-leaf stage of growth. Over the top applications made before the 4-leaf stage or after the 8-leaf stage of development may result in crop injury and/or yield loss. Controls Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. Postemergence applications of PROWL may cause temporary growth reduction and/or leaf discoloration or malformation of cotton following application. **Note:** *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider an alternative postemergence residual herbicide such as WARRANT or DUAL MAGNUM.*

Prowl H_2O 3.8CS (*pendimethalin*)	1.0-2.0 pt	0.48-0.95 lb	3	70 days	24 hours
Prowl 3.3EC	1.2-2.4 pt	0.50-0.99 lb			
+					
Liberty 280SL 2.34S (glufosinate)	29-43 fl oz	0.53-0.79 lb	10		

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS LIBERTY-LINK! Apply PROWL broadcast postemergence over the top after cotton reaches the 4- to 5-leaf stage of growth, but not after the 8-leaf stage of growth. Over the top applications made before the 4-leaf stage or after the 8-leaf stage of development may result in crop injury and/or yield loss. Controls Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. Postemergence applications of PROWL may cause temporary growth reduction and/or leaf discoloration or malformation of cotton following application. **Note:** *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider an alternative postemergence residual herbicide such as WARRANT or DUAL MAGNUM.*

Select 2EC (*clethodim*)	6.0-16.0 oz	0.094-0.25 lb	1	70 days	24 hours
Select MAX 0.97EC	9.0-32.0 oz	0.068-0.24 lb			

Comments: Apply SELECT/SELECT MAX anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 8 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. A second 6 oz/A (6-18 oz/A SELECT MAX) treatment may be applied to control regrowth. For bermudagrass, treat 6" runners with 8 oz/A (16 oz/A SELECT MAX), and apply 8 oz/A (16 oz/A SELECT MAX) to 6" re-growth. Add COC at 1 qt/A plus AMS at 2.5-4.0 lb/A for enhanced johnsongrass and volunteer corn activity. **Rainfast interval = 1 hour.**

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Sequence 5.25L (*glyphosate* + *s-metolachlor*)	2.5 pt	 0.75 lb ae + 0.94 lb	 9 15	100 days	24 hours

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! Apply 2.5 pt/A over-the-top from cotyledon stage up to 10-leaf stage (not to exceed 12-inch cotton). Do not apply after the 10-leaf stage of cotton development as severe injury, including yield loss, may occur. Controls annual grasses and broadleaves. In general, the first over-the-top broadcast application should be applied early to minimize weed competition (1 to 3" tall weeds). Do not add AMS or other adjuvants. This combination provides residual control of annual grasses, pigweeds, Florida pusley, dayflower, and suppression of yellow nutsedge. Do not exceed 3.5 pt/A per season. Do not tank mix with STAPLE. **Rainfast interval = 2 hours.**

Staple LX 3.2SL (*pyrithiobac*)	1.3-3.8 fl oz	0.033-0.095 lb	2	60 days	4 hours

Comments: Apply STAPLE over-the-top or post-directed beginning at the first true leaf stage of cotton to control cocklebur, pigweed, and annual morningglory. *Fair to good performance on Palmer amaranth (less than 2" tall). For heavily infested field with glyphosate-resistant Palmer amaranth, apply STAPLE at 2.6 oz/A.* Add NIS at 1 qt/100 gal of spray solution. May cause temporary leaf yellowing, bronzing, or crinkling particularly under cool conditions. A total of 5.1 oz/A may be applied per season. Allow a minimum of 7 days between applications. STAPLE may be tank-mixed with most insecticides approved for use on cotton. Do not tank mix with any DUAL product. DUAL and STAPLE applications should be spaced apart by at least 5 days. Do not tank-mix with malathion-containing insecticides. To avoid injury, MALATHION insecticide application should be made at least 24 hours before or after a STAPLE application. **Rainfast interval = 4 hours**.

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Warrant 3.0ME (*acetochlor*)	3 pt	1.125 lb	15	---	12 hours

Comments: Apply WARRANT over-the-top from emergence until cotton reaches first bloom. Provides residual control of small seeded broadleaves and grasses. Optimum application timing for first broadcast application is 2-3 leaf stage followed by a second directed application at 5-6 leaf stage (see POST DIRECTED section). Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE (use only on ROUNDUP READY FLEX varieties) or LIBERTY (use only on LIBERTY LINK varieties) for control of existing weeds. Do not apply WARRANT using a sprayable fluid fertilizer as the carrier because of severe crop injury may occur. Do not apply WARRANT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Xtendimax 2.9SL (*dicamba*)	22 fl oz.	0.5 lb ae	4	7 days	24 hours

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS BOLLGARD II XTENDFLEX! Apply XTENDIMAX over-the-top from emergence until 7 days before harvest. *XTENDIMAX with VAPORGRIP technology may only be tank mixed with products (pesticides, adjuvants, and drift control agents) that have been tested and found not to adversely affect offsite movement potential. A list of these approved tank mix partners can be found at www.xtendimaxapplicationrequirements.com*. In addition, some approved COC, HSOC, and MSO adjuvants from the list may cause temporary crop response. *Use only the TeeJet TTI11004 nozzles with a maximum operating pressure of 63 psi when applying XTENDIMAX*. Select a ground speed that will deliver the desired spray volume while maintaining the correct spray pressure, but do not exceed a ground speed of 15 miles per hour (slower speeds typically result in better coverage and deposition in the target area). Do not tank mix products containing ammonium salts, such as ammonium sulfate and urea ammonium nitrate with XTENDIMAX. Apply XTENDIMAX in a minimum of 10 gal of water per acre. Provides control of small broadleaf weeds (less than 4 inches) including glyphosate-resistant Palmer amaranth. Sequential applications may be required to control subsequent new flushes of broadleaf weeds. Allow at least 7 days between applications. For resistance management, avoid making more than 2 single applications of a group 4 herbicide unless mixed with another mechanisum of action. Do not apply XTENDIMAX to cotton with XTENDFLEX technology using aerial spray equipment. Do not make application of XTENDIMAX if rain is expected in next 24 hours. Clean spray equipment immediately after applying XTENDIMAX using a triple rinse method as outlined in the label.

Maximum XTENDIMAX application rates:

Combined total per year for all applications	88 fl oz. per acre (2.0 lb ae dicamba per acre)
Total of preplant, at-planting, and preemergence applications	44 fl oz. per acre (1.0 lb ae dicamba per acre)
Total in-crop applications from emergence up to 7-days before harvest (pre-harvest).	88 fl oz. per acre (2.0 lb ae dicamba per acre)
Maximum in-crop single application	22 fl oz. per acre (0.5 lb ae dicamba per acre)

Wind Speed Requirements when applying XTENDIMAX:

Wind Speed	Application conditions and restrictions
<3 mph	DO NOT APPLY XTENDIMAX with VAPORGRIP technology
3 to 10 mph	Optimum application conditions for XTENDIMAX with VAPORGRIP technology provided all other application requirements in this label are met.
10 to 15 mph	Do not apply this product when wind is blowing toward non-target sensitive areas.
>15 mph	DO NOT APPLY XTENDIMAX with VAPORGRIP technology.

Buffer requirements for sensitive areas when applying XTENDIMAX: Maintain a 110-foot downwind buffer (22 fl oz of XTENDIMAX per acre) or a 220-foot downwind buffer (44 fl oz of XTENDIMAX per acre) between the last treated row and closest downwind edge (in the direction in which the wind is blowing). No application swath can be inititated in, or into an area that is within the applicable buffer distance. The following areas may be included in the buffer distance when adjacent to field edges: roads, paved or gravel surfaces; planted agricultural fields containing corn, dicamba tolerant cotton, dicamba tolerant soybean, sorghum, proso millet, small grains, and sugarcane; agricultural field that have been prepared for planting; and areas covered by the footprint of a building, silo, or other man made structure with walls and/or roof.

Non-target susceptible commercially grown broadleaf crops and trees precautions: Failure to follow application requirements in the XTENDIMAX label could result in severe injury or destruction to desirable sensitive broadleaf crops and trees when contacting the roots, stems, or foliage. Do not apply XTENDIMAX when wind is blowing toward adjacent commercially grown dicamba sensitive broadleaf crops including, but not limited to, commercially grown tomatoes and other fruiting vegetables (EPA crop group 8), cucurbits (EPA crop group 9), and grapes.

AVOIDING SPRAY DRIFT AT THE APPLICATION SITE IS THE RESPONSIBILITY OF THE APPLICATOR!

Weed Response to Postemergence Directed Cotton Herbicides[1]

	Aim	Liberty[2]	MSMA	MSMA + Caparol	MSMA + Cobra	MSMA + Cotoran	MSMA + Direx	MSMA + Layby Pro	MSMA + Suprend	MSMA + Valor	Flexstar GT[3]
anoda, spurred	G	P	P	F	F	FG	F	F	F	G	E
barnyardgrass	P	FG	F	FG	F	F	F	FG	FG	FG	E
beggarweed, Florida	G	P	P	F	F	FG	F	F	F	G	E
bermudagrass	P	P	P	P	P	P	P	P	P	P	F
citronmelon	P	G	F	G	G	G	G	G	G	G	E
cocklebur, common	G	E	E	E	E	E	E	E	E	E	E
cowpea	G	G	FG	G	FG	G	G	G	G	G	E
crabgrass	P	FG	F	FG	F	F	F	FG	FG	FG	E
crotolaria, showy	G	E	G	G	G	G	G	G	G	G	E
croton, tropic	G	G	F	G	E	G	G	G	GE	E	E
crowfootgrass	P	FG	F	FG	F	F	F	FG	FG	FG	E
dayflower, Benghal	P	PF	GE	GE	GE	GE	GE	GE	GE	GE	PF
eclipta	G	G	G	G	G	G	E	E	G	E	E
goosegrass	P	F	F	FG	F	F	F	FG	FG	F	E
jimsonweed	G	E	F	G	GE	GE	G	G	G	G	E
johnsongrass, seedling	P	G	F	FG	F	F	F	FG	FG	F	E
johnsongrass, rhizome	P	F	P	P	P	P	P	P	P	P	G
lambsquarters, common	FG	E	P	G	F	G	G	G	G	G	E
morningglory spp.	GE	E	F	E	E	G	GE	GE	E	E	G
nutsedge, purple	P	P	F	F	F	F	F	F	E	FG	FG
nutsedge, yellow	P	P	FG	FG	FG	FG	G	G	E	G	G
panicum, fall	P	FG	F	FG	F	F	F	FG	FG	FG	E
panicum, Texas	P	P	P	F	P	P	P	F	F	PF	E
pigweed spp.	G	G	P	FG	G	FG	GE	GE	GE	G	E
glyphosate-resistant	G	G	P	FG	G	FG	GE	GE	GE	G	G
ALS-resistant	G	G	P	FG	G	FG	GE	GE	GE	G	E
poinsettia, wild	G	PF	PF	PF	G	F	PF	G	P	G	G
purslane, common	P	F	PF	FG	G	FG	G	G	G	G	FG
pusley, Florida	G	F	P	F	F	F	F	F	F	FG	G
ragweed, common	FG	E	F	E	E	GE	E	E	E	GE	E
redweed (chocolateweed)	G	GE	P	G	GE	FG	GE	GE	G	GE	G
ryegrass, annual	G	FG	P	P	FG	P	GE	GE	P	F	E
sandbur	P	FG	F	FG	F	F	F	FG	FG	F	E
senna, coffee	---	GE	F	G	F	G	G	G	---	G	E
sesbania, hemp	P	---	P	PF	F	PF	PF	---	---	G	GE
sicklepod	P	E	F	GE	PF	G	GE	GE	E	GE	E
sida, prickly	FG	GE	P	GE	GE	FG	GE	GE	GE	GE	G
signalgrass, broadleaf	P	FG	F	FG	F	F	F	FG	FG	F	E
smartweed, Pennsylvania	---	GE	P	F	F	G	F	F	---	G	G
spurge	G	FG	P	G	G	P	G	G	G	G	E
starbur, bristly	---	G	PF	G	G	G	G	G	GE	G	GE
velvetleaf	F	G	P	G	G	F	G	G	FG	G	E
vol. corn	P	G	P	FG	FG	FG	G	G	FG	G	E
RR hybrids	P	G	P	FG	FG	FG	G	G	FG	G	F
RR+LL hybrids	P	P	P	FG	FG	FG	G	G	FG	G	F
vol. peanut	P	E	F	F	F	F	G	G	FG	G	F

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Use only on LibertyLink (LL) cotton varieties

[3]Use only on glyphosate-tolerant (Gly-Tol or Roundup Ready [RR] Flex) cotton varieties.

Weed Response to Postemergence Directed Cotton Herbicides (cont)[1]

	Glyphosate[2]	Glyphosate + Aim/ET[2]	Glyphosate + Caparol[2]	Glyphosate + Direx[2]	Glyphosate + Envoke[2]	Glyphosate + Prowl[2]	Glyphosate + Staple[2]	Glypohsate + Valor[2]	Prefix	Reflex	Sequence[2]	Xtendimax[3]	HOOD Gramoxone + Direx
anoda, spurred	E	E	E	E	E	E	E	E	P	P	E	G	G
barnyardgrass	E	E	E	E	E	E	E	E	P	P	E	P	G
beggarweed, Florida	E	E	E	E	E	E	E	E	G	G	E	G	E
bermudagrass	F	F	F	F	F	F	F	F	P	P	F	P	P
citronmelon	GE	GE	GE	GE	E	GE	E	E	G	G	E	G	G
cocklebur, common	E	E	E	E	E	E	E	E	G	G	E	E	G
cowpea	GE	GE	GE	GE	GE	GE	GE	E	F	F	GE	E	G
crabgrass	E	E	GE	GE	E	E	E	E	P	P	E	P	G
crotolaria, showy	G	G	G	G	G	G	G	G	---	---	G	G	G
croton, tropic	E	E	E	E	E	E	E	E	---	---	E	GE	F
crowfootgrass	E	E	GE	GE	E	E	E	E	P	P	E	P	G
dayflower, Benghal	PF	GE	FG	FG	PF	PF	FG	GE	---	---	PF	P	G
eclipta	E	E	E	E	E	E	E	E	G	G	E	G	F
goosegrass	E	E	GE	GE	E	E	E	E	P	P	E	P	G
jimsonweed	E	E	E	E	E	E	E	E	G	G	E	E	G
johnsongrass, seedling	E	E	GE	GE	E	E	E	E	P	P	E	P	G
johnsongrass, rhizome	GE	GE	G	G	E	GE	GE	GE	P	P	GE	P	P
lambsquarters, common	G	GE	GE	GE	GE	G	GE	GE	FG	FG	G	E	F
morningglory, annual	FG	E	GE	GE	GE	FG	GE	E	G	G	FG	E	FG
nutsedge, purple	FG	FG	FG	FG	GE	FG	FG	GE	FG	P	FG	P	PF
nutsedge, yellow	G	F	F	F	E	G	FG	E	F	P	F	P	PF
panicum, fall	E	E	GE	GE	E	E	E	E	P	P	E	P	G
panicum, Texas	E	E	GE	GE	E	E	E	E	P	P	E	P	G
pigweed spp.	E	E	E	E	E	E	E	E	E	E	E	E	GE
glyphosate-resistant	P	F	F	G	G	P	G	G	E	E	P	E	GE
ALS-resistant	E	E	E	E	E	E	E	E	E	E	E	E	GE
poinsettia, wild	G	GE	GE	G	E	G	G	GE	G	G	GE	E	G
purslane, common	F	G	FG	GE	FG	F	FG	GE	P	P	F	---	G
pusley, Florida	PF	G	G	G	PF	PF	PF	GE	GE	GE	PF	P	PF
ragweed, common	E	E	E	E	E	E	E	E	GE	GE	GE	E	F
redweed (chocolateweed)	GE	GE	GE	GE	GE	GE	GE	GE	G	G	GE	E	FG
ryegrass, annual	E	E	E	E	E	E	E	E	F	F	E	P	F
sandbur, field	E	E	GE	GE	E	E	E	E	P	P	E	P	G
senna, coffee	E	E	E	E	E	E	E	E	FG	FG	GE	E	F
sesbania, hemp	F	GE	GE	FG	FG	F	GE	FG	GE	GE	G	E	F
sicklepod	E	E	E	E	E	E	E	E	FG	FG	E	E	GE
sida, prickly	FG	FG	G	G	FG	FG	G	GE	FG	FG	FG	E	PF
signalgrass, broadleaf	E	E	GE	GE	E	E	E	E	P	P	E	P	GE
smartweed, Pennsylvania	G	GE	G	G	E	G	E	G	---	---	G	E	G
spurge	G	GE	G	GE	G	G	G	G	G	G	G	E	G
starbur, bristly	GE	GE	GE	GE	GE	GE	GE	GE	---	---	GE	E	E
velvetleaf	E	E	E	E	E	E	E	E	PF	PF	E	E	---
vol. corn	E	E	E	E	E	E	E	E	FG	F	E	P	F
RR hybrids	FG	FG	FG	FG	GE	FG	FG	GE	FG	F	FG	P	F
RR+LL hybrids	FG	FG	FG	FG	GE	FG	FG	GE	FG	F	FG	P	F
vol. peanut	G	GE	G	G	FG	FG	F	FG	P	P	G	E	P

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Use only on glyphosate-tolerant (Gly-Tol or Roundup Ready [RR] Flex) cotton varieties

[3]Use only on Bollgard II XtendFlex cotton varieties

Postemergence Directed Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.0-1.6 fl oz	0.013-0.025 lb	14	7 days	12 hours

Aim 1.9EW

Comments: Apply AIM at 1.0-1.6 oz/A when cotton is a minimum of 6" tall (if less than 5-6 nodes, use a hooded sprayer) and where a sufficient height differential exists between crop and weed (3-4"). Care must be taken to ensure that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. For best performance, apply to actively growing weeds less than 4" tall. Coverage is essential for good control. Add COC 1 gal or NIS at 2 pt/100 gallons of spray solution. For additional control of broadleaf and grass weeds, AIM may be tank mixed with other herbicides labeled for cotton post-directed and layby applications.

Caparol 4L (*prometryn*)	1.3-2.4 pt	0.65-1.2 lb	5	---	12 hours

Comments: Apply CAPAROL at 1.3 pt/A when cotton is 6 inches tall and up to 2.4 pt/A when cotton is at least 12" tall before weeds are 2 inches in height. Add NIS at 2 qt/100 gal of spray solution. Tank mix partners may include GLYPHOSATE, MSMA, or GRAMOXONE (hooded applicatations only).

Cobra 2EC (*lactofen*)	6.0-12.5 fl oz	0.094-0.195 lb	14	70 days	12 hours

Comments: Apply COBRA when cotton is 6" tall and where sufficient height differential exists between crop and weed (3-4"). Direct spray to the lower 2 inches of the cotton stem to avoid injury. Apply when weeds are small and actively growing. Adjust nozzles to ensure full coverage of target weeds. Do not apply more than 25 fl oz/A of COBRA per year. Do not apply more than 2 applications of COBRA per season. Do not apply a sequential application of COBRA within 14 days of first application. Tank mix partners may include MSMA or DIURON. **Rainfast interval =30 minutes.**

Cotoran 4L (*fluometuron*)	2.0-4.0 pt	1.0-2.0 lb	7	60 days	24 hours

Comments: Apply COTORAN at 2.0-4.0 pt/A (depending on soil texture) when cotton is at least 3" tall. Add surfactant at 2 qt/100 gal of spray solution. Tank mix partners may include PYRIMAX, PARALLEL PCS, and MSMA.

Diuron 4F (*diuron*)	1.0-1.5 pt	0.4-1.2 lb	7	---	12 hours

Comments: Apply DIREX at 1.0-1.5 pt/A when cotton is at least 6 inches tall (1.0 pt/A on 6-8" tall cotton and 1.5 pt/A on cotton that is 8-12" tall). For enhanced control of emerged weeds, tank mix with MSMA, GLYPHOSATE, or GRAMOXONE (hooded only).

Dual Mag. 7.62 EC (*s-metolachlor*)	1.0-1.33 qt	0.95-1.27 lb	15	80 days	24 hours

Comments: Apply DUAL at 1.0-1.33 pt/A when cotton is at least 3 inches tall. For enhanced control of emerged weeds , tank mix with MSMA, GLYPHOSATE, CAPAROL or COTORAN.

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
ET 0.208EC (*pyraflufen ethyl*)	0.5-1.0 fl oz	0.0008-0.0016 lb	14	7 days	12 hours
ET X 0.338EC	0.3-0.6 fl oz				

Comments: Apply ET at 0.5-1.0 fl oz/A or ET X at 0.3-0.6 fl oz/A when cotton is at least 18" tall and has a minimum of 3" of stem bark. Apply when weeds are less than 4" tall. Avoid contact with desirable foliage. Allow a minimum of 30 days between applications. **Rainfast interval = N/A**

Envoke (*trifloxysulfuron*)	0.1-0.2 oz	0.0047-0.0094 lb	2	60 days	12 hours

Comments: Apply ENVOKE at 0.1-0.2 oz/A when cotton at least 6" tall through layby. For control of emerged weeds (use higher rate for larger weeds; max 4" tall). Add NIS at 2 qt or COC at 1 gal/100 gal of spray solution. **Rainfast interval = 3 hours.**

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Fierce 76WDG (*flumioxazin* + *pyroxasulfone*)	3.0 oz	0.063 lb + 0.080 lb	14 15	60 days	12 hours

Comments: Apply FIERCE at 3.0 oz/A when cotton is at least 6" tall with a directed shielded sprayer. For layby timings, FIERCE applied when cotton is at least 18" tall and should be directed at the lower 2 inches of the cotton stem to avoid injury. FIERCE should be tank mixed with MSMA, DIURON, or GLYPHOSATE to control emerged weeds. Add NIS at 1 qt per 100 gal of spray solution. Do not apply more than 3 oz/A of FIERCE during a single application. Do not apply more 6 oz/A during a single growing season. Do not make a sequential application of FIERCE within 30 days of the first application of FIERCE. **Rainfast interval = 1 hour.**

Flexstar GT 3.5SL (*fomesafen* + *glyphosate*)	3.5 pt	0.25 lb + 0.99 lb ae	14 9	70 days	24 hours

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! For directed applications, apply FLEXSTAR GT to cotton at least 6" tall. Apply FLEXSTAR GT to cotton at least 18" tall with 4" of bark at the base of the plant at layby. Care must be taken so that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. Apply FLEXSTAR GT when weeds are small (2-4 cotyledon stage for broadleaf weeds) and if activated by rainfall will provide residual weed control. Do not apply more than 3.5 pt/A of FLEXSTAR GT per postemergence directed application per year. Tank mix partners may include any herbicide labeled for postemergence directed applications in cotton. **Rainfast interval = 1 hour.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22-32 fl oz	0.75-1.12 lb ae			

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! Apply 0.63 to 1.12 lb ae/A from cracking until 7 days before harvest. Controls annual grasses and broadleaves. Direct spray allows better contact with weeds under the cotton canopy. Best results are obtained when weeds are less than 3" tall. Consult label for maximum application rates allowed during the season. Tank mixes with GLYPHOSATE labeled for post-directed applications to ROUNDUP READY FLEX cotton varieties include AIM, CAPAROL, DIREX, DUAL MAGNUM, DUAL II MAGNUM, ENVOKE, PARRLAY, STAPLE, VALOR, WARRANT, and PENDIMETHALIN. See tank mix partner labels for more information. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Resistance Management: *Glyphosate-resistant (Group 9) Palmer amaranth is spreading rapidly throughout South Carolina. Continued reliance on glyphosate-only programs will enhance selection and spread of resistant biotypes. Tank mixing glyphosate with other chemistries must be utilized.*

Goal 2XL (*oxyflourfen*)	1.0-2.0 pt	0.25-0.5 lb	14	90 days	24 hours
GoalTender	0.5-1.0 pt				

Comments: Apply GOAL/GOALTENDER when cotton is 6 to 8 inches tall. Apply when weeds are small and actively growing preferably when there are not more than 4 true leaves present. Adjust nozzles to ensure full coverage of target weeds. Do not use hollow cone nozzles. Use a minimum of 20 GPA spray volume. Do not apply more than 0.5 lb ai/A of oxyflourfen per season. GOAL/GOALTENDER may be tank mixed with other herbicides registered for postemergence use in cotton.

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Layby Pro 4L	1.0-2.0 pt			76 days	24 hours
(*liuron*		0.25-0.5 lb	7		
+		+			
diuron)		0.25-0.5 lb	7		

Comments: Apply LAYBY PRO at 1.0-1.5 pt/A when cotton at least 8" tall and 1.6-2.0 pt/A when cotton greater than 15" tall. For control of emerged weeds (use higher rate for larger weeds; max 4" tall). Add NIS at 2 qt or COC at 1 gal/100 gal of spray solution. **Rainfast interval = 2 hours.**

Liberty 280 2.34SL (*glufosinate*)	29-43 fl oz	0.53-0.79 lb	10	70 days	12 hours

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS LIBERTY-LINK! Apply LIBERTY at 29 oz/A as a directed application when cotton canopy prevents spray from reaching weeds below. Do not exceed 87 oz/A per season (up to three 29 oz/A applications). If weather conditions prevent a timely 1st application, then LIBERTY may be applied up to 43 oz/A to control larger weeds. If more than 29 oz/A are used in any single application, seasonal total may not exceed 72 oz/A including all application timings. Controls annual grasses and broadleaves. Direct spray allows better contact with weeds under the cotton canopy. Best results are obtained when weeds are less than 3" tall. Direct spray to the lower third of the cotton plant. Add AMS at 3 lb/A to the spray solution. For residual control of weeds, tank mix DUAL MAGNUM, WARRANT, or STAPLE. **Rainfast interval = 4 hours.**

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
MSMA 6L	2.67 pt	2.0 lb	17	---	12 hours

Comments: Apply MSMA when cotton is 3" tall up to first bloom. Do not apply after first bloom. A slight burning or reddish discoloration of the foliage may occur after application; however, cotton plants will develop normally. Add surfactant at 2 qt/100 gal to the spray solution. Do not apply more than 4 lb ai/A of MSMA. **Rainfast interval = 2 hours.**

Prefix 5.29EC	2.0-2.33 pt			80 days	24 hours
(*s-metolachlor*		1.09-1.26 lb	15		
+		+			
fomesafen)		0.24-0.28 lb	14		

Comments: For directed applications, apply PREFIX to cotton at least 6" tall. Apply PREFIX to cotton at least 18" tall with 4" of bark at the base of the plant at layby. Care must be taken so that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. PREFIX will control small emerged weeds (2-4 cotyledons for broadleaf weeds) and if activated by rainfall within 7-10 days will provide residual weed control. Add NIS at 1-2 qt or COC at 1 gal/100 gallons of spray solution. Do not apply more than 2.33 pt/A of PREFIX per season. Do not add liquid nitrogen to PREFIX tank mixes in cotton. Tank mix partners may include CAPAROL, DSMA, DIREX, ENVOKE, KARMEX, LAYBY PRO, MSMA, GLYPHOSATE (glyphosate-tolerant cotton varieties only), and SUPREND. **Rainfast interval = N/A.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Prowl H20 3.8CS	1.0-2.0 pt			60 days	24 hours
(*pendimethalin*)		0.48-0.95 lb	3		
Prowl 3.3EC	1.2-2.4 pt				

Comments: Apply PROWL directly to the soil between rows as a directed spray following the last cultivation. Layby applications can be applied in cotton previously treated with PROWL. However, the total amount of PROWL applied per acre per season cannot exceed the highest label rate of PROWL for the given soil type. Controls Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. **Note:** *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider alternative soil residual partner for GLYPHOSATE (i.e., DUAL or WARRANT).* ***Rainfast interval = N/A.***

Sequence 5.25SL	2.5 pt			50 days	24 hours
(*glyphosate*		0.75 lb ae	9		
+		+			
s-metolachlor)		0.94 lb	15		

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! Apply SEQUENCE at 2.5 pt/A up to 12" tall cotton (10 leaf stage). Do not apply later in cotton development as severe injury, including yield loss, may occur. Controls annual grasses and broadleaves. Best results are obtained when weeds are less than 3" tall. Do not exceed 3.5 pt/A of Sequence per season. Can be tank mixed with CENTRIC or KARATE insecticides. **Rainfast interval = heavy rainfall shortly after application require retreatment.**

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Suprend 80WDG (*prometryn* + *trifloxysulfuron*)	1.0-1.5 lb	0.79-1.18 lb + 0.007-0.0105 lb	7 + 2	60 days	12 hours

Comments: Apply SUPREND at 1.0-1.5 lb/A when cotton is at least 6" tall. For control of emerged weeds (use higher rate for larger weeds; less than 6" tall). Add surfactant at 2 qt/100 gal to the spray solution. Do not tank mix SUPREND with MALATHION, PROFENFOS, DENIM, ACEPHATE, BIDRIN, CAPTURE, KARATE or unacceptable crop injury may occur. Do not exceed 0.0188 lb ai/A of trifloxysulfuron per year. **Rainfast interval = 3 hours.**

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Valor SX 51WDG (*flumioxazin*)	1.0-2.0 oz	0.032-0.064 lb	14	21 days	12 hours

Comments: Apply VALOR SX at 2 oz/A when cotton is at least 18" tall as a direct spray to contact only lower 2" of bark on stem (no spray contacts green foliage or unbarked stem). Do not apply MSMA after first bloom. Add NIS at 1 qt/100 gal of spray solution. Do not use COC, MSO, organo-silicone adjuvants, or any adjuvant containing any of these. **Rainfast interval = 2 hours.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Warrant 3.0ME (*acetochlor*)	1.5-2.0 qt	1.125 lb	15	---	12 hours

Comments: Apply WARRANT postemergence directed from 5-6 leaf stage until cotton reaches first bloom. Provides residual control of small seeded broadleaves and grasses. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE (use only on ROUNDUP READY FLEX varieties) or LIBERTY (use only on LIBERTY LINK varieties) for control of existing weeds. Do not apply WARRANT using a sprayable fluid fertilizer as the carrier because of severe crop injury may occur. Do not apply WARRANT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Hooded Sprayer Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
ET 0.208EC (*pyraflufen ethyl*)	0.5-1.0 fl oz	0.0008-0.0033 lb	14	7 days	12 hours
ET X 0.335EC	0.3-1.25 fl oz				

Comments: Apply ET at 0.5-1.0 fl oz/A or ETX at 0.3-1.25 fl oz/A when cotton is 18 inches or more and has a least 3 inches of stem bark using hooded ground equipment only. Apply when weeds are less than 4" tall. Avoid contact with desirable foliage. Allow a minimum of 30 days between applications. Do not exceed 0.0033 lb ai PYRAFLUFEN ETHYL per season.

Fierce 76WDG (*flumioxazin* + *pyroxasulfone*)	3.0 oz	0.063 lb + 0.080 lb	14 + 15	60 days	12 hours

Comments: Apply FIERCE at 3.0 oz/A when cotton is at least 6" tall with a hooded sprayer. FIERCE should be tank mixed with MSMA, DIURON, or GLYPHOSATE to control emerged weeds. Add NIS at 1 qt per 100 gal of spray solution. Do not apply more than 3 oz/A of FIERCE during a single application. Do not apply more 6 oz/A during a single growing season. Do not make a sequential application of FIERCE within 30 days of the first application of FIERCE. **Rainfast interval = 1 hour**

Flexstar GT 3.5SL (*fomesafen* + *glyphosate*)	3.5 pt	0.25 lb + 0.99 lb ae	14 + 9	70 days	24 hours

Comments: For hooded or shielded sprayer applications, apply FLEXSTAR GT to cotton at least 6" tall. Care must be taken so that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. Apply FLEXSTAR GT when weeds are small (2-4 cotyledon stage for broadleaf weeds) and if activated by rainfall will provide residual weed control. Adjust nozzles to ensure full coverage of target weeds. Do not apply more than 3.5 pt/A of FLEXSTAR GT per postemergence directed application per year. Tank mix partners may include any herbicide labeled for postemergence directed applications in cotton. **Rainfast interval = 1 hour.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Glyphosate acid equivalent (ae)			9	7 days	12 hours
4.5 lb ae/gal	22 fl oz	0.75 lb ae			

Comments: Hoods should be kept as close to the ground as possible in conventional and non-Roundup Ready cotton varieties. Do not allow the spray to contact stems or foliage of non-Roundup Ready cotton. Apply in 5 -10 GPA at a maximum of 25 PSI. Do not exceed 5 MPH. Cotton should be at least 8" tall. See GLYPHOSATE product label for adjuvant recommendation. Tank mixes with CAPAROL, DIREX, ENVOKE, LAYBY PRO, STAPLE, PROWL, and VALOR will enhance residual weed control. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Resistance Management: *Glyphosate-resistant Palmer amaranth is spreading rapidly throughout South Carolina. Continued reliance on glyphosate-only programs will enhance selection and spread of resistant biotypes. Tank mixing glyphosate with other chemistries must be used.*

Hooded Sprayer Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL 2S (*paraquat*)	1.2-2.0 pt	0.3-0.5 lb	22	15 days	24 hours

Comments: Hoods should be kept as close to the ground as possible. Do not allow the spray to contact stems or foliage of cotton. Apply in a minimum of 10 GPA at a maximum of 25 PSI. Do not exceed 5 MPH. Cotton should be at least 8" tall. Add NIS at 2 pt or COC at 1 gal/100 gal of spray solution. Allow 14 days between multiple applications. CAPAROL or DIREX may be tank mixed with GRAMOXONE and will enhance residual weed control. **Rainfast interval = 30 minutes.**

Liberty 280 2.34SL (*glufosinate*)	29-43 fl oz	0.53-0.79 lb	10	70 days	12 hours

Comments: Hoods should be kept as close to the ground as possible in conventional and non-Liberty-Link cotton varieties. Do not allow the spray to contact stems or foliage of cotton. Apply in a minimum of 15 GPA at a maximum of 25 PSI. Do not exceed 5 MPH. Apply LIBERTY at 29-43 oz/A as a hooded application when cotton canopy prevents spray from reaching weeds below. Cotton should be at least 8" tall. Do not exceed 87 oz/A per season from all application sources. Add AMS at 3 lb/A to the spray solution. For non-Liberty-Link varieties, Tank mix partners for hooded applications of LIBERTY include AIM, CAPAROL, COTORAN, DIREX, DUAL MAGNUM, GLYPHOSATE, KARMEX, PENDIMAX, PROWL, SELECT MAX, and STAPLE. **Rainfast interval = 4 hours.**

Prefix 5.29EC (*s-metolachlor* + *fomesafen*)	2.0-2.33 pt	1.09-1.26 lb + 0.24-0.28 lb	15 + 14	80 days	24 hours

Comments: For hooded or shielded sprayer applications, apply PREFIX to cotton at least 6" tall. Care must be taken so that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. PREFIX will control small emerged weeds (2-4 cotyledons for broadleaf weeds) and if activated by rainfall within 7-10 days will provide residual weed control. Add NIS at 1-2 qt or COC at 1 gal/100 gallons of spray solution. Do not apply more than 2.33 pt/A of PREFIX per season. Tank mix partners include CAPAROL, DSMA, DIREX, ENVOKE, KARMEX, LAYBY PRO, MSMA, GLYPHOSATE (glyphosate-tolerant cotton varieties only), and SUPREND. **Rainfast period = N/A (suggest 1 hour)**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Harvest Aids for Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.6 fl oz	0.025 lb	14	7 days	12 hours
Aim 1.9EW					
Comments: Apply AIM up to 1.6 oz/A after 60 to 70% of the bolls are open. Use a minimum of 10 gallons per acre for ground applications and 5 gallons per acre for aerial applications. Coverage is essential for good defoliation. A repeat application of up to 1.6 oz/A is allowed if foliage is remaining or regrowth is occurring. Dense canopy, large plant sizes, and environmental conditions non-conducive to complete plant coverage may reduce initial application performance and increase need for a second application. AIM may be tank mixed with PREP, FINISH, DEF, DROPP, FOLEX, HARVADE, GINSTAR, COTTONQUIK, or other registered cotton harvest aid products. Do not apply more than 3.2 oz/A per season as a harvest aid. Add a NIS a 0.25% v/v (warmer periods of defoliation) or COC at 1 gal per 100 gal (cooler periods of defoliation). **Rainfast interval = 6-8 hours.**					
ET 0.208 EC (*pyraflufen ethyl*)	1.5-2.75 fl oz	0.0024-0.0045 lb	14	7 days	12 hours
Comments: Apply ET up to 2.75 oz/A when bolls are 60% open. Use a minimum of 20 gallons per acre for ground applications or 5 gallons per acre for aerial applications. Coverage is essential for good defoliation. Adequate defoliation is generally achieved within 7 to 14 days after application. A repeat application of up to 2.75 oz/A is allowed if foliage is remaining or regrowth is occurring. Do not exceed 2 applications or 5.5 oz/A of ET for defoliation of cotton. Applications must be made a minimum of 7 days apart. ET may be tank mixed with COTTONQUIK, CYCLONE, DEF, DROPP, FINISH, FOLEX, GINSTAR, PREP, GRAMOXONE, and/or GLYPHOSATE. **Rainfast interval = 1 hour.**					
Glyphosate acid equivalent (ae)			9	7 days	12 hours
4.5 lb ae/gal	22-44 fl oz	0.75-1.5 lb ae			
Comments: Apply GLYPHOSATE after 60% of the bolls are open (non-Roundup Ready cotton). Can be tank mixed with some defoliants; see labels for details. Apply to Roundup Ready cotton varieties after 20% cracked boll stage or to Roundup Ready FLEX cotton up to 7 days before harvest. Do not apply GLYHOSTE to cotton grown for seed as a reduction in vigor or germination may occur. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**					
Gramoxone SL 2S (*paraquat*)	8.0 fl oz	0.13 lb	22	7 days	12 hours
paraquat 3S	5.4 fl oz				
Comments: Defoliate cotton as normal. After at least 75-80% of bolls are open, the remaining bolls expected to be harvested are mature, and most of the cotton leaves have dropped, apply GRAMOXONE in a minimum of 20 GPA and add 1 pt NIS per 100 gal of spray solution. **Rainfast interval = 30 minutes.**					

COTTON INSECT MANAGEMENT

Jeremy K. Greene, Research/Extension Entomologist

Insect pests are major limiting factors in producing cotton in South Carolina. Hundreds of species of insects may be found in cotton, but only a limited number of those species are economically important. A cotton scout must be able to identify the damaging species of insects as well as the common beneficial arthropods. A good scouting program is still the first line of defense against insect pests in cotton. There are many valid techniques that can be used to assess the impact of insects in a field of cotton. The following information is intended to serve as a guide for use in monitoring and controlling infestations of pestiferous insects in cotton. Insecticide treatments should only be applied when numbers of insect pests reach levels that correspond to economic thresholds. Avoid treating infestations that are below thresholds because unnecessary disruptions to populations of beneficial species often result in plant injury by other insect pests.

Since 1996, cotton growers in South Carolina have planted cotton varieties protected from tobacco budworm and bollworm by genes derived from the bacterium, *Bacillus thuringiensis* (Bt). Genes transferred from Bt to cotton enable plants to produce proteins toxic to caterpillars. Cells of leaves, stems, squares, blooms and bolls of these genetically engineered cotton plants contain lethal doses of the toxin. When caterpillars eat the Cry-proteins, their digestive enzymes activate the toxic form of the protein. The Cry-proteins bind to receptors on the lining of the insect gut, and cells are ruptured. The poisoned insects stop feeding within a few hours and die within 2 or 3 days if the dose is sufficiently high. Varieties with single-gene (first-generation) Bt technology provided excellent control (virtually 100%) of tobacco budworm and fair-to-good (about 60 to 90%) control of bollworm over the years (1996-2010). In South Carolina, there was insufficient control of bollworm with single-gene Bt cotton alone, and supplemental applications of insecticides were needed to prevent economic damage.

Thresholds for bollworm in first-generation Bt cotton were developed in response to observations that many problems with bollworm occurred in fields of Bt cotton where there had been moderate to high levels of eggs. For this reason, thresholds were adopted that called for insecticide treatments when egg and small worm numbers were excessive, especially if scouts would be unable to get back within a few days to assess infestations of larvae. An egg threshold of 75 eggs per 100 plants was instituted in the 1997 crop year, along with a threshold of 30 small worms per 100 plants. Square damage has been a poorer indicator of economic damage in Bt cotton, as most surviving larvae have been found in association with bolls and attached dried blooms (commonly called "bloom tags"). Researchers have shown that Bt toxins are apparently expressed in lower concentrations in blooms, pollen, and dried bloom tags, creating a window of opportunity for small bollworms. If small larvae can survive and grow for several days, they are not likely to be killed by Bt toxins.

Since 2011, almost 100% of the cotton acreage in South Carolina was planted to varieties containing two Bt genes for production of dual Cry-proteins. Research has shown that, when additional genes are added that produce supplementary toxic proteins, effectiveness against lepidopteran pests such as bollworms, armyworms, and soybean loopers increases. Availability of Bt technologies changed on 30 September 2009 when the last opportunity to purchase first-generation Bt cotton (Bollgard varieties – for example DP555BR) for planting during the 2010 season expired (i.e. the phasing out of single-gene Bt varieties). Beginning with the 2011 season, only dual-Bt-gene cotton varieties were commericially available. Varieties expressing more than two Bt proteins are now available and continue to be approved and tested.

Cotton with Bt technology has many potential benefits in terms of insect control, but there will continue to be potential problems with stink bugs and other arthropod pests that are not controlled by Bt toxins and that benefit from reduced use of insecticides. Although Bt cotton has offered good-to-excellent control of important caterpillar pests, the best way to maximize benefits of planting transgenic Bt cotton is to scout vigilantly for pests, allowing properly timed sprays when necessary and detecting additional potential shifts in species importance. Researchers with Clemson University will continue to evaluate insect pest thresholds and control methods with new transgenic varieties, and adjustments will be made to recommendations as deemed appropriate.

INSECT PESTS

Thrips feed on leaves and terminals of seedling plants, thereby stunting growth and delaying maturity. Damaged leaves appear crinkled on top, and lower surfaces will often have a silvery sheen. Leaf margins become cupped and terminal buds may be destroyed. Tobacco thrips, *Frankliniella fusca*, is the predominant species encountered in cotton in South Carolina.

Aphids typically infest plant terminals and uppermost leaves initially. These soft-bodied insects have piercing-sucking mouthparts that are used to suck plant juices from leaves and stems. Heavy infestations on the undersides of leaves produce wilting and cause the leaf margins to curl toward the ground. A parasitic wasp and a fungus, *Neozygites fresenii*, often provide adequate aphid control. **Whiteflies** can also damage cotton by sucking plant fluids, but this happens very rarely in South Carolina. These insects are generally controlled by naturally occurring beneficial arthropods before their damage can reduce yields. Both aphids and whiteflies excrete a substance with a high sugar content referred to as honeydew. Heavy infestations of aphids or whiteflies can produce large amounts of honeydew, thereby coating lower leaves, and giving them a shiny appearance. After mature bolls have opened, honeydew may produce sticky lint. Honeydew may also serve as a substrate for the growth of a sooty mold, which stains lint and reduces color grade.

Plant bugs (tarnished plant bug and cotton fleahopper) infrequently cause problems in June and July. Tarnished plant bugs may also puncture small bolls, inflicting damage symptoms similar to that caused by stink bugs. Adults of both species of plant bugs move to cotton from wild host plants. *Lygus* bugs develop in wild hosts such as aster, blue vervain, and fleabane, while fleahoppers are fond of tropic croton and primrose. Both adults and nymphs feed on small squares and other tender plant parts.

Tobacco budworm populations have been increasing during recent years. Historically, most problems with tobacco budworms have occurred in the Coastal Plain from moths that deposited eggs during June (pre-bloom). However, in recent years, populations of tobacco budworm have been detected in early July. Tobacco budworm and bollworm are often called the bollworm/budworm complex because they will often be present in the same field, they eat the same plant structures, and they are morphologically quite similar as larvae. Before first bloom, in non-Bt cotton, fields should be treated when 15 or more small (<0.25 inch) larvae or 20 damaged squares are found per 100 plants. After first bloom, in non-Bt cotton that has not been treated previously, insecticide should be applied at 20 or more eggs, 3 small larvae, or 5% damaged squares per 100 plants. Tobacco budworms have been documented to be resistant to multiple insecticide classes, so insecticide choices are limited in non-Bt cotton. Pyrethroid-resistant tobacco budworms occur in cotton in South Carolina and should be considered resistant to that class of chemistry.

Bollworm (corn earworm) is a key insect pest of cotton in South Carolina because it will infest most fields in the state every year. Infestations are most likely to occur in July after moths that have emerged from corn fields begin to deposit eggs on cotton plants. In the Coastal-Plain region, moth flights will usually begin within the period from 6 to 20 July, with the earliest flights occurring in the Savannah Valley area. Bollworms have generally been less of a threat in the Piedmont region, where infestations generally don't materialize before the last week in July. Insecticide applications will be triggered when the numbers of eggs, larvae, or damage reach economic levels (economic thresholds). Scouting for eggs and hatching larvae is a responsibility of a cotton scout. After bollworm moths have deposited their eggs on cotton plants, the eggs will begin hatching in about three days. Eggs are deposited singly and generally on the upper leaf surfaces near plant terminals. By mid-July or later, moths may deposit a higher percentage of eggs lower on the plants on leaves, squares, stems, and even blooms or dried blooms (bloom tags). Scouts should check whole plants for bollworm eggs and larvae and examine the following fruiting forms on each plant: a white bloom, a pink bloom and the two smallest bolls. Remove bloom tags to look for damage on the tips of small bolls where bollworm larvae often gain entry. Historically, in first-generation Bt cotton, an insecticide treatment was recommended when 30 or more small (<0.25 inch in length) larvae were found per 100 plants, and the threshold for bollworms that were not controlled with Bt cotton (commonly called "escaped worm threshold") was three larger (≥0.25 inch in length) larvae per 100 plants or 5% damaged bolls. Treatment thresholds for bollworm in second-generation Bt cotton are being re-evaluated, but the best available options are to consider intervention when egg numbers approach 100 or more per 100 plants for consecutive weeks, when three large (≥0.25 inch in length) larvae are found per 100 plants, or when 5% of bolls are damaged by bollworm. After first bloom, in non-Bt cotton, insecticide should be applied at 20 or more eggs, 3 small larvae, or 5% damaged squares per 100 plants. Cotton fields should be checked at least once a week, from seedling emergence through the first week in July. More frequent scouting is recommended from early July through mid August, primarily to detect hatch-out of bollworm larvae. Thereafter, weekly field visits should continue until most plants have reached a stage of maturity considered relatively safe from insect damage.

In 1996 pyrethroid-resistant bollworms were found in cotton fields in Hampton County near Estill, SC. Vial tests conducted with moths trapped in the Savannah Valley in 1997 confirmed the presence of resistance. Also, pyrethroid resistance was confirmed from fields in Orangeburg and Calhoun Counties in August of 1997. Both of these fields were characterized by the presence of numerous large bollworms following multiple applications of pyrethroids. Pyrethroid resistance was documented in five locations below the lakes in 1998 from bollworms collected in fields where there had been control problems. Recent studies have shown that rates of survival shown by bollworm in adult vial tests and reported from confirmed field collections after exposure to pyrethroids are increasing, indicating that pyrethroid-resistance genes are still present. Efforts to monitor pyrethroid resistance will continue, but rotation of insecticide class is recommended as part of a resistance management approach. Avoiding consecutive applications of pyrethroids for bollworm would be one possible tactic to delay development of resistance. See detailed recommendations for bollworm insecticides that can be used as alternatives to pyrethroids.

Beet and fall armyworms usually do not occur until late July or early August, as neither species is known to overwinter in South Carolina. Moths of both species lay eggs in masses of 80 to 100 on the undersides of leaves. Newly emerged fall armyworms (first instars) tend to feed singly on the younger growth within the middle portion of a plant. Small beet armyworms are gregarious, and will feed in clusters on the undersides of leaves through third instars. When small larvae feed on the inner surfaces of square bracts, the etchings will be visible externally. Fall armyworms are often found in blooms, where they feed on floral tissue and pollen. Like bollworms, fall armyworms will eventually damage larger bolls. Beet armyworms feed on squares and blooms, but they usually do not bore into bolls. Large beet armyworms are capable of completely defoliating non-*Bt* cotton plants. Second- and third-generation Bt cotton varieties do a very good job in controlling armyworms, but they are not immune from injury, and subtle differences in efficacy exist among the technologies (see GENETIC INSECT CONTROL below).

Spider mites are occasionally a problem in South Carolina cotton. Infestations of mites are often flared by extremely hot and dry weather conditions. Applications of insecticides (e.g. acephate) for other pests may also flare infestations of spider mites by reducing the numbers of beneficial arthropods that prey upon them. Initial infestations occur from spider mites moving from wild host plants or other crops into border rows of cotton. Yellow speckling on the upper surfaces of leaves (in proximity to petiole attachment) will be the first indication of a mite infestation. As mites continue to feed on the undersides of leaves, the upper surfaces will become reddened. Early recognition of these symptoms, and spot treating infested areas, will often prevent spider mites from spreading throughout a field.

Stink bugs have piercing-sucking mouthparts that they use to pierce small bolls and suck sap from the seeds. Seed coats more or less collapse, and the attached lint often acquires a yellowish to brownish colored stain. Small, warty growths on the inside of a boll wall will generally mark the points of penetration. Warts typically form within 48 hours after penetration. Water-soaked lesions are signs of more recent penetrations, where warts may not have had time to develop. Warts may never develop when a stink bug penetrates the boll wall, fails to find a seed, and then quickly withdraws its beak. Furthermore, warts do not form on bolls that have reached full size. Damaged bolls may open prematurely or become hard-locked. Usually only one or two locks will be damaged, but occasionally, if infestations are heavy, bolls may be completely hard locked. Boll damage is the main criterion used to evaluate infestations of stink bugs. A scout should randomly select 25 or more quarter-sized bolls, break them open, and check the inner walls of the bolls for the damage symptoms indicated above. Care should be taken to ensure that all bolls examined are of the same age class because these will provide the most reliable estimate of the actual current damage in a field. When damage symptoms are present, look for adults and large nymphs by shaking plants over a beat cloth or into a plastic pan where they can be examined and identified. It is possible that plant bugs or other sucking insects might damage small bolls, so identification is important before action is taken. By the time a boll is 25 days old, it should be relatively safe from attack.

ACTION THRESHOLDS

Compare numbers on scouting reports to recommended action thresholds described in the remarks after each table in the insecticide recommendations section to help determine need for an insecticide treatment. One must also consider factors such as the stage of plant growth or whether the cotton is a Bt or not-Bt variety. For some insect pests, such as bollworm, insect numbers or damaged-square counts are provided to enable a grower to determine whether or not an insecticide application is warranted. Action thresholds are not well defined for every insect pest, and deciding whether or not to treat may be more difficult. In these situations, there is often a greater likelihood of treating a field when it is

unnecessary. Threshold numbers are general in nature and are subject to professional interpretation. County agents and cotton consultants should have the expertise to help determine how these thresholds best apply to field situations on a particular farm.

RESISTANCE MANAGEMENT IN BT COTTON

Most varieties of cotton contain Bt technology (options listed in table below) for controlling caterpillar pests in the crop. A structured cotton refuge is no longer required for Bt cotton, but a "natural refuge" option is available for any brand of cottonseed containing Bt traits. Companies provide guidance about resistance management and product stewardship with Bt technology at the following web pages:

http://www.monsanto.com/products/pages/insect-resistance-management.aspx
http://www.dowagro.com/phytogen/stewardship/
https://www.bayercropscience.us/products/traits/twinlink/resistance-management

GENETIC INSECT CONTROL

Trade name	Bollworm	Tobacco budworm	Beet armyworm	Fall armyworm	Soybean looper	Cutworm
Bollgard II	Excellent	Excellent	Excellent	Good	Excellent	Poor
Bollgard 3*	Excellent	Excellent	Excellent	Excellent	Excellent	Poor
WideStrike	Good	Excellent	Excellent	Good	Good	Poor
WideStrike 3	Excellent	Excellent	Excellent	Excellent	Excellent	Poor
TwinLink	Excellent	Excellent	Excellent	Good	Excellent	Poor
TwinLink Plus*	Excellent	Excellent	Excellent	Excellent	Excellent	Poor

Transgenic Bt varieties offer cotton growers a unique technological tool for the management of lepidopterous insect pests. There are differences in their relative effectiveness against several species that are common in South Carolina.
*Limited availability in 2017.

COTTON INSECT CONTROL RECOMMENDATIONS

"Instant –View" Threshold Guide

Insect	Number per unit
Stink bugs (SB)	20% injury to medium-sized bolls; 10% during wk 3-5 of bloom; bugs present
Bollworms *2nd & 3rd generation Bt cotton*	After 1st bloom, consider treatment soon after peak egg lay or > 1 egg/plant, 3 or more larger (>0.25 inch) larvae per 100 plants, or 5% damaged bolls
Bollworms *Non-Bt cotton*	After 1st bloom: 20 or more eggs or 3 small (<0.25 inch) larvae per 100 plants or 5% damaged squares
Tobacco budworms (TBW) *Non-Bt cotton only – not found in Bt cotton*	Before 1st bloom: 15 small (<0.25 inch) larvae per 100 plants or 20% damaged squares; after 1st bloom: 20 eggs or 3 small larvae per 100 plants or 5% damaged squares
Thrips	2 or more thrips per plant (less if immatures) and damage present
Aphids	Plants severely infested and stressed with actively growing colonies present
Fall armyworms (FAW)	10 or more per 100 plants, checking blooms and bolls
Spider mites	50% of plants infested and stressed with actively growing colonies present

This quick-view threshold table was intended to be a quick reference for treatment thresholds for the most common insect pests of cotton in South Carolina. The sections described hereafter include detailed information about thresholds and specific insecticide recommendations.

THRIPS

Product (at planting)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	**Comments**
aldicarb **(R)**		0.525-0.75		48 hr	90 d	In-furrow
AgLogic 15 G or Temik 15 G	3.5-5.0 lb		-			granular
thiamethoxam		-		12 hr	-	Seed
Cruiser	-		-			treatment
Avicta Duo	-		-			
Acceleron (check coding)	-		-			
imidacloprid		-		12 hr	-	Seed
Gaucho 600	-		-			treatment
Aeris	-		-			
Acceleron (check coding)	-		-			
acephate		0.97		24 hr	21 d	In-furrow
Orthene/Acephate 97	16.0 oz		-			spray
Orthene/Acephate 90	17.2 oz		-			
phorate **(R)**		1.0		48 hr	60 d	In-furrow
Thimet 20 G	5.0 lb		-			granular
imidacloprid		0.33		12 hr	14 d	In-furrow
Couraze 4 F	10.55 oz		12.1			spray; seed trt
Couraze 2 F	21.1 oz		6.0			+ IFS not to
Admire Pro 4.6	9.2 oz		13.9			exceed 0.5
Velum Total 3.67	14-18 oz	(0.237-0.305)	7.1-9.1			lb/acre total
Product (foliar sprays)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	**Comments**
dicrotophos **(R)**		0.2		6 d	30 d	3.2 oz limit
Bidrin 8 E	3.2 oz		40			pre-square
acephate		0.18		24 hr	21 d	
Orthene/Acephate 97	3.0 oz		-			
Orthene/Acephate 90	3.2 oz		-			
dimethoate		0.25		48 hr	14 d	
Dimethoate 4 EC	8.0 oz		16			
spinetoram		0.0117-0.0234		4 hr	28 d	Adjuvant
Radiant 1 SC	1.5-3.0 oz		42.7-85.3			recommended

The high rate of aldicarb should also provide some protection against nematodes and suppress early populations of aphids and spider mites. When cotton is planted after May 20, seed treatments have proven to be effective in limiting thrips damage to seedling cotton plants. Avicta (with abamectin) and Aeris (with thiodicarb) have some activity on

nematodes. Generally, a preventative insecticide used at planting will protect seedlings from severe stunting characteristic of thrips injury. Occasionally, however, conditions will be unfavorable for proper uptake of systemic insecticides (too cool, dry soil, excessive moisture, etc.), and plants can be severely damaged. **Foliar treatments will be most effective when applied to cotton seedlings prior to unfolding of the second true leaf**. A foliar insecticide treatment may be needed when two or more thrips are found per plant. Shake each plant (randomly select 25 or more) into a coffee cup or a similar utensil to facilitate counting. When most plants have severely damaged growing points and immature thrips are present, one or more foliar treatments may be needed to allow the plants to resume normal growth and development. Examine plants 5-7 days after the initial treatment, and treat again if immatures are still present on most plants. When the newly unfolded leaves of infested plants are free of damage, and plants appear to be growing at a normal rate, further applications of insecticides will have little benefit. Treatments applied beyond the four-leaf stage of growth may actually be counterproductive, as these would likely reduce beneficial populations and result in early-season problems with other pests. Although effective, acephate can flare populations of spider mites and aphids.

CUTWORMS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
chlorpyrifos **(R)**		0.70-1.0		24 hr	14 d	
Lorsban 4 E	1.5-2.0 pt	(0.75-1.0)	4.0-5.3			
Nufos 4 E	1.5-2.0 pt	(0.75-1.0)	4.0-5.3			
Lorsban Advanced 3.755	1.5-2.0 pt	(0.70-0.94)	4.0-5.3			
acephate		0.73-0.97		24 hr	21 d	
Orthene/Acephate 97	12.0-16.0 oz		-			
Orthene/Acephate 90	13.0-16.0 oz		-			
beta-cyfluthrin **(R)**		0.0065-0.025		12 hr	0 d	
Baythroid XL 1 EC	0.8-1.6 oz		80-160			
lambda-cyhalothrin **(R)**		0.015-0.02		24 hr	21 d	
Karate Z 2.08 CS	0.96-1.28 oz		100-133			
Karate 1 EC	1.92-2.56 oz		50-67			
Silencer 1 EC	1.92-2.56 oz		50-67			
Lambda-Cy 1 EC	1.92-2.56 oz		50-67			
cypermethrin **(R)**		0.026-0.097		12 hr	14 d	
Up-Cyde 2.5 EC	1.35-5.0 oz		25.6-94.8			
zeta-cypermethrin/ bifenthrin **(R)**		0.05-0.1		12 hr	14 d	
Hero 1.24 EC	5.2-10.3 oz		12.4-24.6			
esfenvalerate **(R)**		0.03-0.05		12 hr	21 d	
Asana XL 0.66 EC	5.8-9.6 oz		13-22			
gamma-cyhalothrin **(R)**		0.0075-0.01		24 hr	21 d	
Declare 1.25 CS	0.77-1.02 oz		125-166			
zeta-cypermethrin **(R)**		0.008-0.012		12 hr	14 d	
Mustang Max 0.8 EC	1.28-1.92 oz		67-100			
bifenthrin **(R)**		0.04-0.1		12 hr	14 d	
Discipline 2 EC	2.6-6.4 oz		20-50			
Brigade 2 EC	2.6-6.4 oz		20-50			
Fanfare 2 EC	2.6-6.4 oz		20-50			
Bifenture 2 EC	2.6-6.4 oz		20-50			

Treat when cutworms threaten to reduce plant populations below an acceptable level. The risk of infestations will be greater under reduced tillage conditions and in heavier soils, where cutworms can become established on existing vegetation and will move to cotton when it emerges. Destroying established vegetation 3 to 4 weeks before planting will often prevent cutworm problems. Some of the listed insecticides may be used as “rescue” treatments on cotton seedlings and some are labeled for pre-emergence use as either broadcast, banded, or in-furrow sprays. At-planting treatments may be warranted in situations where cutworms are already established and vegetation cannot be destroyed ahead of time. Often lower rates of insecticide can be use for these preventative at-plant treatments.

APHIDS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
sulfoxaflor				24 hr	14 d	End user
Transform 50 WG	0.75-1.0 oz	0.23-0.031	-			stocks only
acetamiprid		0.025-0.05		12 hr	28 d	Ovicidal
Assail 30 SG	1.5-2.5 oz		-			activity on
Assail 70 WP (Intruder 70)	0.6-1.1 oz		-			caterpillars
dicrotophos		0.5		6 d	30 d	16 oz limit
Bidrin 8	8.0 oz		16			post bloom
flonicamid		0.044-0.088		12 hr	30 d	
Carbine 50 WG	1.4-2.8 oz		-			
thiamethoxam		0.031-0.05		12 hr	21 d	5 oz limit for
Centric 40 WG	1.25-2.0 oz		-			season
imidacloprid		0.031-0.0625		12 hr	14 d	
Couraze 4 F	1.0-2.0 oz		64-128			
Couraze 2 F	2.0-4.0 oz		32-64			
Admire Pro 4.6	0.9-1.7 oz		75-142			
clothianidin		0.05-0.1		12 hr	21 d	12 oz limit for
Belay 2.13	3.0-6.0 oz		21.3-42.6			season

Treat only when high numbers of aphids are severely infesting plants, populations are building, and the margins of terminal leaves are drooping. Aphids will cause more damage when plants are suffering from lack of moisture, and there are few signs of natural control agents. If there is evidence of widespread parasitism (dead aphids, tan colored and swollen in appearance) and/or fungal pathogens (diseased aphid bodies have a grayish-green colored fuzzy appearance) an insecticide should not be applied. Avoid unnecessary insecticide applications, as subsequent reductions in beneficial populations can result in damage from bollworm and fall armyworm.

PLANT BUGS (COTTON FLEAHOPPER AND TARNISHED PLANT BUG)

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
acephate		0.25-0.75		24 hr	21 d	
Orthene/Acephate 97	4.1-12.3 oz		-			
Orthene/Acephate 90	4.4-13.3 oz		-			
imidacloprid		0.031-0.0625		12 hr	14 d	
Couraze 4 F	1.5-2.0 oz		64-83			
Couraze 2 F	3.0-4.0 oz		32-42.6			
Admire Pro 4.6	0.9-1.7 oz		75-142			
thiamethoxam		0.05-0.0625		12 hr	21 d	5 oz limit for
Centric 40 WG	2.0-2.5 oz		-			season
flonicamid		0.088		12 hr	30 d	
Carbine 50 WG	2.8 oz		-			
dicrotophos **(R)**		0.25-0.5		6 d	30 d	16 oz limit
Bidrin 8 E	4.0-8.0 oz		16-32			post bloom

Product (plant bugs cont.)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
oxamyl **(R)**		0.25-0.5		48 hr	14 d	
Vydate 3.77 CLV	8.5-17.0 oz		7.5-15			
clothianidin		0.05-0.1		12 hr	21 d	12 oz limit for season
Belay 2.13	3.0-6.0 oz		21.3-42.6			
novaluron		0.058-0.078		12 hr	30 d	Effective on nymphs only
Diamond 0.83 EC	9.0-12.0 oz		14.2-21.3			
sulfoxaflor				24 hr	14 d	End user stocks only
Transform 50 WG	0.75-2.25 oz	0.23-0.071	-			

Plant-bug injury to squares rarely causes economic problems in South Carolina. An economic problem could develop if an early-maturing variety was planted late, an average of one plant bug per foot of row is detected using a beat cloth or beat pan, or 25% or more of pinhead squares have been lost. Pyrethroid insecticides generally provide control of plant bugs when applied at stink bug/bollworm control rates. Avoid treating Bt cotton for plant bugs unless absolutely necessary in June and July as subsequent reductions in beneficial populations often trigger problems with bollworm or fall armyworm. Plant bugs can also injure small bolls like stink bugs. For combinations of plant bugs and stink bugs feeding on small bolls, use boll-injury treatment thresholds for stink bugs.

ARMYWORMS (BEET AND FALL ARMYWORM)

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt cotton	-	-	-	-	-	
emamectin benzoate **(R)**		0.0075-0.015		12 hr	21 d	Suppression of spider mites
Denim 0.16 EC (BAW)	6.0-8.0 oz		16-21.3			
Denim 0.16 EC (FAW)	8.0-12.0 oz		10.7-16			
indoxacarb		0.09-0.11		12 hr	14 d	
Steward 1.25 EC	9.2-11.3 oz		11.5-14			
methoxyfenozide		0.0625-0.156		4 hr	14 d	Higher rates for FAW
Intrepid 2 F	4.0-10.0 oz		12.8-32			
novaluron		0.058-0.078		12 hr	30 d	
Diamond 0.83 EC	9.0-12.0 oz		10.7-14.2			
spinosad				4 hr	28 d	Existing stocks of Tracer
Tracer 4 SC	2.14-2.9 oz	0.067-0.09	44-60			
Blackhawk 36 WG	2.4-3.2 oz	0.054-0.072	-			
methomyl **(R)**		0.45-0.675		3 d	15 d	May redden leaves
Lannate 2.4 LV (FAW)	1.5-2.25 pt		3.6-5.3			
chlorantraniliprole		0.045-0.09		4 hr	21 d	5-d interval/ application
Coragen 1.67 SC	3.5-7.0 oz		18.3-36.5			
Prevathon 0.43 SC	14.0-27.0 oz		4.7-9.1			
flubendiamide		0.0625-0.094		12 hr	28 d	Can use until supply gone
Belt 4 SC	2.0-3.0 oz		42.6-64			

Varieties containing two or more Bt endotoxins should provide good control of armyworms. Control of fall armyworms (FAW) may be justified when 10 or more larvae are found per 100 plants. Check blooms for the presence of FAW and look for feeding symptoms on boll bracts in the lower canopy. For beet armyworms (BAW) consider applying an insecticide when there are larvae present in noticeable numbers and damage is easily observed. Populations of BAW can develop on pigweeds in the field and move to cotton and overcome the Bt toxins. Pyrethroids applied for control of stink bugs and bollworm will also provide some degree of control of eggs and newly hatched armyworms; however, after the worms have fed on cotton plants, these materials will be less effective. Best control is achieved when applications of insecticide are timed to coincide with egg hatch and emerging larvae.

BOLLWORM

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt cotton	-	-	-	-	-	
Product (pyrethoids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	**Comments**
bifenthrin **(R)**		0.04-0.1		12 hr	14 d	Control of
Discipline 2 EC	2.6-6.4 oz		20-50			spider mites
Brigade 2 EC	2.6-6.4 oz		20-50			possible at
Fanfare 2 EC	2.6-6.4 oz		20-50			high rates
Bifenture 2 EC	2.6-6.4 oz		20-50			
beta-cyfluthrin **(R)**		0.0125-0.02		12 hr	0 d	
Baythroid XL 1 EC	1.6-2.6 oz		49-80			
lambda-cyhalothrin **(R)**		0.025-0.04		24 hr	21 d	
Karate Z 2.08 CS	1.6-2.5 oz		50-80			
Karate 1 EC	3.2-5.12 oz		25-40			
Silencer 1 EC	3.2-5.12 oz		25-40			
Lambda-Cy 1 EC	3.2-5.12 oz		25-40			
cypermethrin **(R)**		0.04-0.1		12 hr	14 d	
Up-Cyde 2.5 EC	2.0-5.0 oz		25-64			
zeta-cypermethrin/ bifenthrin **(R)**		0.05-0.1		12 hr	14 d	
Hero 1.24 EC	5.2-10.3 oz		12.4-24.6			
esfenvalerate **(R)**		0.05		12 hr	21 d	
Asana XL 0.66 EC	9.6 oz		13			
gamma-cyhalothrin **(R)**		0.0125-0.02		24 hr	21 d	
Declare 1.25 CS	1.28-2.05 oz		63-100			
zeta-cypermethrin **(R)**		0.017-0.0225		12 hr	14 d	
Mustang Max 0.8 EC	2.64-3.6 oz		35-48			
Product (non-pyrethoids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	**Comments**
novaluron		0.078-0.09		12 hr	30 d	Apply at egg
Diamond 0.83 EC	12.0-14.0 oz		9.1-10.6			hatch
indoxacarb		0.11		12 hr	14 d	
Steward 1.25 EC	11.3 oz		11.5			
spinosad				4 hr	28 d	Existing
Tracer 4 SC	2.14-2.9 oz	0.067-0.09	44-60			stocks of
Blackhawk 36 WG	2.4-3.2 oz	0.054-0.072	-			Tracer
emamectin benzoate **(R)**		0.01-0.015		12 hr	21 d	Spider mite
Denim 0.16 EC	8.0-12.0 oz		10.7-16			suppression
methomyl **(R)**		0.45-0.675		72 hr	15 d	May redden
Lannate 2.4 LV	1.5-2.25 pt		3.5-5.3			leaves
flubendiamide		0.0625-0.094		12 hr	28 d	Can use until
Belt 4 SC	2.0-3.0 oz		42.6-64			supply gone
chlorantraniliprole		0.065-0.09		4 hr	21 d	5-d interval/
Coragen 1.67 SC	5.0-7.0 oz		18.3-25.6			application
Prevathon 0.43 SC	20.0-27.0 oz		4.7-6.4			

To reduce selection pressure for resistance in bollworm, avoid using pyrethroid insecticides before 1 July, unless infestations are extremely high. In transgenic cotton varieties that contain Bt endotoxins, an insecticide treatment should not be needed before first bloom. Transgenic Bt cotton varieties that have two or more Bt genes have increased efficacies against bollworms; however, under potential situations of very heavy pressure from bollworm, some Bt technologies, particularly WideStrike, can incur significant injury and losses if not protected with supplemental/timely application(s) of insecticide. To control escaped worms in Bt cotton, an insecticide treatment should be applied when 3 or more larger (>0.25 inch) worms are found per 100 plants or 5% of small bolls are damaged. Also, entire plants can be examined for eggs to determine pending pressure. Insecticide application can be justified if peak egg lay approaches 1 egg per plant. On each plant a scout should examine a white bloom, a pink bloom, and the two smallest bolls. If dried blooms (bloom tags) adhere to small bolls, remove them and look for larvae boring into the boll tips. AFTER FIRST BLOOM, in non-Bt cotton that has not been previously treated, apply an initial insecticide treatment when 20 eggs or 3 small larvae are found per 100 plants or at 5% damaged squares. On non-Bt cotton, two treatments might be required

to control bollworms following the initial moth flight in July. AFTER MID-AUGUST, consider the maturity of the crop in determining the need for a treatment. For example, 3 small worms or 5% damaged squares may still be an applicable threshold in late-maturing non-Bt cotton (early- to mid-bloom stage of development), but this infestation level could be tolerated in cotton that is nearing cutout, where most bolls are too mature to be damaged by bollworm.

BUDWORM (TOBACCO BUDWORM)

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt Cotton	-	-	-	-	-	
spinosad				4 hr	28 d	Existing stocks of Tracer
Tracer 4 SC	1.4-2.9 oz	0.044-0.09	44-91.4			
Blackhawk 36 WG	1.6-3.2 oz	0.036-0.072	-			
indoxacarb		0.11		12 hr	14 d	
Steward 1.25 EC	11.3 oz		11.5			
novaluron		0.078-0.09		12 hr	30 d	Apply at egg hatch
Diamond 0.83 EC	12.0-14.0 oz		9.1-10.6			
methomyl **(R)**		0.45-0.675		72 hr	15 d	May redden leaves
Lannate 2.4 LV	1.5-2.25 pt		3.5-5.3			
emamectin benzoate **(R)**		0.01-0.015		12 hr	21 d	Spider mite suppression
Denim 0.16 EC	8.0-12.0 oz		10.7-16			
flubendiamide		0.0625-0.094		12 hr	28 d	Can use until supply gone
Belt 4 SC	2.0-3.0 oz		42.6-64			
chlorantraniliprole		0.065-0.09		4 hr	21 d	5-d interval/ application
Coragen 1.67 SC	5.0-7.0 oz		18.3-25.6			
Prevathon 0.43 SC	20.0-27.0 oz		4.7-6.4			

Varieties containing Bt endotoxins will provide excellent control of tobacco budworm. Insecticides listed for tobacco budworm will provide effective alternatives to the pyrethroids for early- to late-season control where there have been control failures, and for use in resistance management. Indoxacarb and spinosad will conserve beneficial insects and spiders. Spinosad and all of the pyrethroids have activity on eggs of bollworm/tobacco budworm. When treatments are applied using an egg threshold, some eggs will be killed prior to larval emergence. Steward has low ovicidal activity, but when applied to eggs in the blackhead stage, larvae may be killed soon after emergence from consuming the eggshells. BEFORE FIRST BLOOM, in cotton varieties that do not contain Bt endotoxin(s), treat when 15 small (<0.25 inch) larvae are found per 100 plant terminals, or 20% of squares are damaged. AFTER FIRST BLOOM, in non-Bt cotton, insecticide should be applied at 20 or more eggs, 3 small larvae, or 5% damaged squares per 100 plants.

SOYBEAN LOOPER AND CABBAGE LOOPER

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt cotton	-	-	-	-	-	
spinosad				4 hr	28 d	Existing
Tracer 4 SC	2.14-2.9 oz	0.067-0.09	44-60			stocks of
Blackhawk 36 WG	2.4-3.2 oz	0.054-0.072	-			Tracer
indoxacarb		0.065-0.09		12 hr	14 d	
Steward 1.25 EC	6.7-9.2 oz		14-19			
novaluron		0.039-0.078		12 hr	30 d	
Diamond 0.83 EC	6.0-12.0 oz		10.7-21.3			
methoxyfenozide		0.0625-0.156		4 hr	14 d	
Intrepid 2 F	4.0-10.0 oz		12.8-32			
emamectin benzoate **(R)**		0.01-0.015		12 hr	21 d	Spider mite
Denim 0.16 EC	8.0-12.0 oz		10.7-16			suppression
flubendiamide		0.0625-0.094		12 hr	28 d	Can use until
Belt 4 SC	2.0-3.0 oz		42.6-64			supply gone

Varieties containing two or more Bt endotoxins will provide excellent control of loopers. Apply an insecticide treatment when there is 25% or more defoliation and harvestable bolls are still developing. There are two species of loopers that defoliate cotton. The cabbage looper is generally controlled by any of the listed insecticides. The soybean looper is more difficult to control and is resistant to most insecticides. Varieties producing two or more Bt toxins will provide very good control of loopers.

SPIDER MITES

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
chlorpyrifos **(R)**		0.47-0.50		24 hr	14 d	Do not graze
Lorsban 4 E	16.0 oz	(0.50)	8			treated areas
Nufos 4 E	16.0 oz	(0.50)	8			or use gin
Lorsban Advanced 3.755	16.0 oz	(0.47)	8			trash as feed
bifenthrin **(R)**		0.06-0.1		12 hr	14 d	Higher rates
Discipline 2 EC	3.8-6.4 oz		20-33.7			required for
Brigade 2 EC	3.8-6.4 oz		20-33.7			adequate
Fanfare 2 EC	3.8-6.4 oz		20-33.7			control
Bifenture 2 EC	3.8-6.4 oz		20-33.7			
propargite		0.82-1.69		7 d	50 d	Do not apply
Comite 6.55	16.0-32.0 oz		4-8			until plants
Comite II 6	20.0-36.0 oz		3.55-6.4			are 12 in tall
spiromesifen		0.125-0.25		12 hr	30 d	Per season 32
Oberon 2 SC	8.0-16.0 oz		8-16			oz limit
Oberon 4 SC	4.0-8.0 oz		16-32			16 oz limit
etoxazole		0.03-0.045		12 hr	28 d	Max of 1
Zeal 72.7 WSP	0.66-1.0 oz		-			application
abamectin **(R)**		0.009-0.0188		12 hr	20 d	32 oz limit
Agri-Mek 0.15 EC	8.0-16.0 oz		8-16			per season
Zoro 0.15 EC	8.0-16.0 oz		8-16			
fepyroximate		0.05-0.1		12 hr	14 d	Limit of 2 pt
Portal 0.4	16.0-32.0 oz		4-8			per season

Infestations of spider mites usually appear in border rows of a field or sometimes in isolated spots within a field. When mites first appear, treating border rows or spot treating may prevent outbreaks.

STINK BUGS

Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
dicrotophos **(R)**		0.25-0.5	16-32	6 d	30 d	16 oz limit post bloom. Low rates for tank mix only
Bidrin 8 E	4.0-8.0 oz					
acephate		0.5-0.75		24 hr	21 d	
Orthene/Acephate 97	0.52-0.77 lb		-			
Orthene/Acephate 90	0.55-0.83 lb		-			
oxamyl **(R)**		0.4-0.5		48 hr	14 d	
Vydate 3.77 CLV	13.6-17.0 oz		7.5-9.4			
novaluron		0.058-0.09		12 hr	30 d	Effective on nymphs only
Diamond 0.83 EC	9.0-14.0 oz		9.1-14.2			
Product (pyrethroids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	**Comments**
bifenthrin **(R)**		0.04-0.1		12 hr	14 d	Control of spider mites at high rates
Discipline 2 EC	2.6-6.4 oz		20-50			
Brigade 2 EC	2.6-6.4 oz		20-50			
Fanfare 2 EC	2.6-6.4 oz		20-50			
Bifenture 2 EC	2.6-6.4 oz		20-50			
beta-cyfluthrin **(R)**		0.0125-0.02		12 hr	0 d	
Baythroid XL 1 EC	1.6-2.6 oz		49-80			
lambda-cyhalothrin **(R)**		0.025-0.04		24 hr	21 d	
Karate Z 2.08 CS	1.6-2.5 oz		50-80			
Karate 1 EC	3.2-5.12 oz		25-40			
Silencer 1 EC	3.2-5.12 oz		25-40			
Lambda-Cy 1 EC	3.2-5.12 oz		25-40			
cypermethrin **(R)**		0.04-0.1		12 hr	14 d	
Up-Cyde 2.5 EC	2.0-5.0 oz		25-64			
zeta-cypermethrin/ bifenthrin **(R)**		0.05-0.1		12 hr	14 d	
Hero 1.24 EC	5.2-10.3 oz		12.4-24.6			
esfenvalerate **(R)**		0.05		12 hr	21 d	
Asana XL 0.66 EC	9.6 oz		13			
gamma-cyhalothrin **(R)**		0.0125-0.02		24 hr	21 d	
Declare 1.25 CS	1.28-2.05 oz		63-100			
zeta-cypermethrin **(R)**		0.017-0.0225		12 hr	14 d	
Mustang Max 0.8 EC	2.64-3.6 oz		35-48			
alpha-cypermethrin **(R)**		0.023				
Fastac 0.83 EC	3.6 oz		35.5	12 hr	21 d	

Treat when medium-sized bolls display symptoms of feeding injury by week of bloom (50, 30, 10, 10, 10, 20, 30, 50%) and stink bugs are present. Begin scouting for stink bugs when small bolls appear. Consider using a more aggressive (i.e. 10%) threshold during weeks 3-5 of bloom, as bolls developing during this growth stage are particularly susceptible. Randomly select at least 25 bolls (at least a quarter [1 inch] in diameter) per field (add 1 additional boll for each acre exceeding 25 acres). Break each boll open and examine the carpal walls, lint, and seeds for injury symptoms. Look for the presence of warty growths on the carpal walls and for discolored seed and lint. To ensure the accuracy of this sampling method, do not deviate from weekly checking of quarter-size diameter bolls. One may also rate an infestation based upon numbers of stink bugs by using a 3-ft beat cloth. When this method is used, an insecticide treatment will be warranted for 1 or more stink bugs per 6 feet of row. Carefully approach and shake the plants on at least 30 feet of row (10, 3-ft samples). Pyrethroids applied for bollworm control will generally provide control of stink bugs as well. Bidrin should be used in a pyrethroid tank-mix in fields with infestations predominated by brown stink bugs. Be especially vigilant for stink bugs when no treatments are being applied for control of caterpillars.

WHITEFLIES

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
acephate		0.5-1.0		24 hr	21 d	
Orthene/Acephate 97	8.2-16.5 oz		-			
Orthene/Acephate 90	8.9-17.8 oz		-			
acetamiprid		0.075-0.1		12 hr	28 d	Ovicidal activity
Assail 30 SG	4.0-5.3 oz		-			
Assail 70 WP	1.7-2.3 oz		-			
Intruder 70 WSP	1.7-2.3 oz		-			
thiamethoxam		0.05-0.0625		12 hr	21 d	5 oz limit for season
Centric 40 WG	2.0-2.5 oz		-			
imidacloprid		0.031-0.0625		12 hr	14 d	
Couraze 4 F	1.0-2.0 oz		64-128			
Couraze 2 F	2.0-4.0 oz		32-64			
Admire Pro 4.6	0.9-1.7 oz		75-142			
pyriproxyfen		0.0538-0.067		12 hr	28 d	An IGR with slow activity
Knack 0.86	8.0-10.0 oz		12.8-16			

Treat fruiting cotton when 50% of plant terminals have whiteflies present in heavy clusters on the undersides of leaves and immatures are present. Treat mature cotton when clusters of whiteflies are present in terminals, bolls are opening, and honeydew is found. Infestations are rare and usually bandedwinged whiteflies. Use higher rates for suppression of difficult-to-control silverleaf whiteflies.

MULTIPLE PESTS – PRE-MIXED OR CO-PACKAGED PRODUCTS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comment
imidacloprid/*beta*-cyfluthrin **(R)**		0.066-0.075		12 hr	14 d	
Leverage 360	2.8-3.2 oz		40-45.7			Pre-mixed
thiamethoxam/*lambda*-cyhalothrin **(R)**		0.056-0.096		24 hr	21 d	
Endigo 2.06 ZC	3.5-6.0 oz		21.3-36.6			Pre-mixed
imidacloprid/bifenthrin **(R)**		0.06-0.12		12 hr	14 d	
Brigadier 2 SC	3.8-7.7 oz		16.6-33.7			Pre-mixed
spinosad/*gamma*-cyhalothrin **(R)**	1 unit per					
Consero CP	32-45 acres	-	-	24 hr	28 d	Co-pack
dicrotophos/bifenthrin **(R)**		0.41-0.5		6 d	30 d	
Bidrin XP II	10.5-12.8 oz		-			Pre-mixed
chlorantraniliprole/*lambda*-cyhalothrin **(R)**		0.063-0.122	10.2-19.7	24 hr	21 d	
Besiege 1.25 ZC	6.5-12.5 oz					Pre-mixed
chlorpyrifos/*gamma*-cyhalothrin **(R)**		0.518-0.757		24 hr	21 d	
Cobalt 2.55	26.0-38.0 oz		3.37-4.9			Pre-mixed
chlorpyrifos/*lambda*-cyhalothrin **(R)**		0.328-0.78		24 hr	21 d	
Cobalt Advanced 2.63	16.0-38.0 oz		3.37-8.0			Pre-mixed
bifenthrin/avermectin **(R)**		0.068-0.115		12 hr	20 d	
Athena 0.87	10.0-17.0 oz		7.5-12.8			Pre-mixed
diflubenzuron/*lambda*-cyhalothrin **(R)**		0.07-0.0938		24 hr	21 d	
DoubleTake 3	3.0-4.0 oz		32-42.7			Pre-mixed
methoxyfenozide/spinetoram		0.094-0.188		4 hr	28 d	
Intrepid Edge 3	4.0-8.0 oz		16-32			Pre-mixed

For control of multiple pests exceeding thresholds, including but not limited to various combinations of the following: bollworm, beet and fall armyworms, grasshoppers, aphids, plant bugs, stink bugs, and spider mites.

ai = active ingredient; **(R)** = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

TREATMENT TIPS

• Scout your fields regularly to determine insect population levels and to time insecticide applications.
• Where control problems occur, check your sprayer calibration and insecticide rates to ensure they are correct. *Be especially suspicious of high percentages of bollworms surviving multiple applications of pyrethroids.* Suspected resistance problems should be reported to county agents immediately.
• Use high rates, and avoid low rates.
• Insecticides will be much more effective against bollworms when applied within the first 48 hr after hatch-out.
• Use higher spray volumes during hot weather and when control of bollworms is difficult.
• Applying insecticides in oil may increase their effectiveness during unusually hot weather or during rainy weather.
• Hollow cone nozzles are superior to flat fan nozzles in getting good coverage of leaves and other plant parts. TX6 or TX8 tips provide excellent coverage at 7 to 10 gallons per acre and 60 psi.
• CAUTION: It is prohibited to spray blooming cotton with pyrethroids when bees are actively foraging.

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COTTON DISEASE CONTROL

John D. Mueller, Extension Cotton Pathologist

SEEDLING DISEASES

Seedling diseases occur on cotton in South Carolina every year. *Rhizoctonia solani* is the most common pathogen with *Pythium* spp. occurring primarily on early-planted cotton or cotton planted on heavy or cool, wet soils. One or both of these seedling pathogens are present in almost every cotton field. Disease incidence and severity in a given field are determined by environmental factors such as soil temperature and moisture and by seed quality and vigor. Seedling disease management relies on the integration of cultural practices and prudent use of fungicides. There are no varieties that offer any level of resistance to seedling diseases. Crop rotation is also ineffective since *Rhizoctonia solani* and *Pythium* spp. are capable of infecting most commonly grown rotation crops such as corn, peanuts and soybean. The most important cultural practice to limit seedling disease severity is to delay planting until soil temperatures at the 4-inch depth are above 68° F for three consecutive days.

In general, the fungicides which control *R. solani* do not control *Pythium* spp. and the fungicides which control *Pythium* spp. do not control *R. solani*. Therefore, using a combination of fungicides which control the two fungi will provide the highest probability of limiting damage from seedling diseases. If higher levels of protection are desired than are provided by the base treatments provided by seed companies, in-furrow fungicides will provide the highest level of control. Liquid in-furrow fungicides are more effective than granular in-furrow fungicides. Commercially applied additional seed treatments are normally effective except under extremely high disease pressure. Grower-applied seed treatments or hopper-box treatments provide the lowest levels of additional control. The fungicide must be thoroughly mixed with the seed to achieve disease control. Seed treatment products that include fungicides and insecticides are available. Always read the label. Do not use treated seed for feed or food.

FUNGICIDES AVAILABLE FOR COMMERCIAL SEED TREATMENTS, INCLUDING COMBINATIONS OF FUNGICIDES, INSECTICIDES AND NEMATICIDES.

Fungi controlled	Product	Application method	Re-entry interval	Comments
Pythium spp.	Apron XL	Commercial seed treatment	48 hrs.	Must be applied by commercial seed treaters.
R. solani	EverGol Prime	Commercial seed treatment	12 hours (see label exceptions)	Must be applied using commercial slurry or mist-type seed treatment equipment
Fusarium spp. *+ Pythium* spp. *+ R. solani*	Seed Shield Cotton	Commercial seed treatment	See Label	Must be applied by commercial seed treaters.
Fusarium spp. *+ Pythium* spp. *+ R. solani*	Trilex Advanced	Commercial seed treatment	See label	Must be applied by commercial seed treaters.
Fusarium spp. *+ R. solani*	Vortex	Commercial seed treatment	See label	Must be applied by commercial seed treaters.

AVAILABLE HOPPER BOX OR SEED TREATMENTS

Fungi controlled	Product	Application Method	Rate per 100 lb. seed	Re-entry interval	Comments
Pythium spp.	Allegiance-FL	Seed Treatment	0.75 – 1.5 oz	24 hrs.	See label for specific directions on applying this product
Pythium spp.	Allegiance-LS	Seed Treatment	1.2 - 2.4 fl. oz.	24 hrs.	See label for specific directions on applying this product
Pythium spp. + *R. solani*	Dynasty CST	Seed treatment	3.1 – 3.95 fl. oz.	48 hrs.	Be sure to thoroughly mix product with seed. Always use high-quality planting seed.
Fusarium spp. + *R. solani*	Kodiak HB	Hopper box	4.0 – 8.0 oz.	Not applicable	This is a biological control agent (*Bacillus subtilis* GB03) which is best used in combination with chemical seed treatments. See label for application instructions
See Label	Manzate Pro-Stick	Hopper box	3.0 oz	24 hours	See label
See Label	Manzate Max	Hopper box	4.8 fl. oz.	24 hrs.	See label
Fusarium spp. + *R. solani*	Maxim 4FS	Hopper box	0.08 – 0.16 fl. oz.	12 hrs.	Be sure to thoroughly mix product with seed. Always use high-quality planting seed
See label	Penncozeb 80WP	Hopper box	3.0 oz	24 hrs.	See label
See label	Penncozeb 75DF	Hopper box	3.2 oz	24 hrs	See label
Pythium spp. + *R. solani*	Prevail	Hopper box	8.0 – 16.0 oz.	Not Applicable	Be sure to thoroughly mix product with seed. Always use high-quality planting seed.
R. solani	Spera 240 FS	Commercial or Hopper box	1.25 – 4.0 fl. oz.	48 hrs.	Available for commercial or hopper box treatments. See label for directions
Pythium spp. + *R. solani*	Trilex 2000	Seed treatment	2.0 fl. oz.	24 hrs.	Be sure to thoroughly mix product with seed. Always use high-quality planting seed.
R. solani	Vibrance	Seed treatment	0.08 – 0.60 fl. oz.	12 hrs.	Be sure to thoroughly mix product with seed. Always use high-quality planting seed.

IN-FURROW FUNGICIDES

Fungus controlled	Product	Application Method	Rate per 1,000 row ft.	Re-entry interval	Comments
Pythium spp.	Reason 500 SC Fungicide	In-furrow liquid spray	0.45 fl. oz.	12 hrs.	Apply in a spray volume of 3 to 5 gal per acre. Direct the spray in-furrow behind seed drop but before furrow closure
Pythium spp.	Ridomil Gold GR	In-furrow granular	1.5 – 3.0 oz.	48 hrs.	Controls only seed rots caused by *Pythium* spp.
Pythium spp.	Ridomil Gold SL	In-furrow liquid spray	0.075 - 0.15 oz.	48 hrs.	For use primarily in early-planted cotton with cool, wet soils
Pythium spp.	Terramaster 4EC	In-furrow liquid spray	4.0 to 8.0 fl. oz. per acre based on 40 inch rows.	12 hrs.	Mix with 5 to 15 gallons of water.
R. solani	Headline SC fungicide	In-furrow	0.1 – 0.8 fl. oz.	12 hrs.	Use a minimum of 2.5 gallons of water per acre. Apply into the furrow before the seed is covered.
R. solani	Meteor	In-furrow liquid spray	0.25 to 0.5 fl. oz.	24 hrs	Apply in at least 2.5 gal. water per acre to deliver in an open seed furrow
R. solani	Priaxor	In-furrow liquid spray	0.2 to 0.6 fl. oz.		Apply in at least 2.5 gal. water per acre into an open seed furrow
R. solani	Rovral 4 Flowable Fungicide	In-furrow	0.25 – 0.5 fl. oz.	4 hrs.	Apply at planting as a banded spray over the seed and covering soil
R. solani	Headline	In-furrow liquid	0.4 - 0.8 fl. oz. /1000 row ft.	12 hrs.	Spray a 4-8 inch band over seed prior to covering with soil
R. solani + *Pythium* spp.	Quadris Flowable	In-furrow liquid	0.40 - 0.80 oz. /1000 row ft.	4 hrs.	Apply as a spray in 5 to 15 gal. of water over the open furrow at planting to the soil around the seed and covering soil.
R. solani + *Pythium* spp.	Ridomil Gold PC GR	In-furrow granular	8.6 – 12.3 oz. /1,000 row ft.	48 hrs.	Apply product at planting over the seed and to covering soil
Fusarium spp. + *R. solani* + *Pythium* spp.	Terraclor Super X 18.8G	In-furrow	6.7 - 12.3 oz. /1000 ft. row	12 hrs.	Apply product at planting over the seed and to covering soil
R. solani + *Pythium* spp.	UNIFORM	In-furrow spray	0.32 - 0.48 fl. oz. /1000 ft. row	0 hrs.	Apply as an in-furrow spray in 5 to 15 gallons of water per acre at planting.

LEAF SPOTS AND BOLL ROTS

Most leaf spots caused by fungi are not severe enough to warrant fungicide applications. In many cases disease severity is increased by nutrient deficiencies, especially shortages of potassium. Leaf spots that occur in South Carolina include Alternaria leaf spot, Ascochyta blight, Cercospora leaf spot, Phoma blight, and Stemphylium leaf spot. Boll rots are caused by many different fungi. These include Alternaria boll rots, Anthracnose boll rot, Ascochyta boll rot, Diplodia boll rot, and Phoma boll rot. Many boll rots are caused by bacteria and cannot be controlled by a fungicide. Control of either leaf spots or boll rots with fungicides is difficult to achieve. In recent years Target spot, caused by *Corynespora cassiicola*, has become common in some areas of the Southeastern United States including the Savannah Valley of South Carolina. There are fungicides are labeled for Target spot control. However, reliable application timings and rates have not been established. Always read the label for appropriate application rates.

FUNGICIDES FOR FOLIAR APPLICATIONS ON COTTON

Diseases controlled	Product	Application method	Rate	Re-entry interval	Comments
Numerous leaf spots and boll rots: see label for specific fungi	Elatus	Foliar spray	5.0 – 7.3 fl. oz. per acre	12 hrs.	45 day preharvest interval. Only two applications are allowed.
Numerous leaf spots and boll rots: see label for specific fungi	Headline fungicide	Foliar spray	6.0 – 12.0 fl. oz. per acre	12 hrs.	30 day preharvest interval. Two applications are allowed
Numerous leaf spots and boll rots: see label for specific fungi	Headline SC fungicide	Foliar spray	6.0 – 12 fl. oz. per acre	12 hrs.	30 day preharvest interval. Two applications are allowed
Numerous leaf spots and boll rots; see label for specific fungi	Priaxor	Foliar spray	4.0 – 8.0 fl. oz. per acre	12 hrs.	30 day preharvest interval. Maximum application of 24 fl. oz. per acre per season. Maximum 3 applications per season.
Numerous leaf spots and boll rots: see label for specific fungi	Quadris	Foliar spray	6 – 9 fl. oz. per acre	12 hrs.	45 day preharvest interval. Maximum application of 27 fl. oz./acre/season
Numerous leaf spots and boll rots: see label for specific fungi	Topguard	Foliar spray	7 to 14 oz. per acre	12 hrs.	30 day preharvest interval. Only 2 applications allowed per year.
Numerous leaf spots and boll rots: see label for specific fungi	TwinLine	Foliar spray	7 - 8.5 fl. oz. per acre	12 hrs.	30-day preharvest interval. Three applications are allowed.

COTTON NEMATODE CONTROL

John D. Mueller, Extension Cotton Pathologist

Nematodes pose a serious threat to cotton production in South Carolina. Not every field is infested with damaging levels of nematodes. However, in the fields that are infested, yield losses range from barely detectable to over 50 percent. Almost half of all fields have at least one nematode species over damage threshold levels. Management tools for any of the three major nematode species are limited. Deep tillage is useful in managing yield losses caused by all three species. In the last several years cotton varieties that are resistant/tolerant to Southern root-knot nematode have become available from several companies. Included in this list of resistant/tolerant varieties are: PHY 367 WRF, PHY 427 WRF, ST 5458 B2RF, ST 4288 B2RF, ST 4946 GLB2, DP 1454*NR* B2RF, DP 1558*NR* B2RF. This resistance is effective only against Southern root-knot nematode. For information on cotton nematode management using host plant resistance, crop rotation, cover crops, or planting dates see the latest Cotton Production Guide.

Nematicide Use: Nematicides are broken out into two major groups based on nematode pressure. The first group is for use in fields with high nematode population levels. Telone II is the only "stand alone" nematicide for fields with heavy nematode pressure. It is applied as a pre-plant fumigant. Other treatment regimens for fields with heavy nematode pressure include Temik 15G in-furrow at-planting plus post-emergence applications of Temik 15G side-dressed or Vydate C-LV sprayed over the top. The second group of nematicides can be used in fields with low to moderate nematode pressure. It includes Temik 15G in-furrow at-planting and also commercial seed treatments including AVICTA Complete Pak or AERIS Seed Treatment System. AVICTA Complete Pak contains a nematicide (Abamectin), an insecticide (Cruiser) and a combination of fungicides (Dynasty CST). AERIS Seed Treatment System contains a nematicide (Larvin) and an insecticide (Gaucho Grande). The inclusion of Trilex Advanced Seed Applied System fungicides is optional. Vydate C-LV can also be applied post-emergence in combination with at-plant treatments of Temik 15G or seed treatments such as AVICTA Complete Pak or AERIS Seed Treatment System for additional control in fields with low to moderate nematode pressure. A Section 18 label for Counter 20G for the 2015 growing season has been applied for but not yet approved. If it is approved, you will need to have a Section 18 label in your possession as you use it and will need to check that specific label for rules and restrictions.

FUMIGANT, GRANULAR, AND LIQUID NEMATICIDES AVAILABLE IN SOUTH CAROLINA FOR CONTROL OF NEMATODES. SEE LABELS FOR SPECIFIC SPECIES CONTROLLED BY EACH PRODUCT.

Nematode level	Product	Rate/acre for 38 inch rows	Application Method	Re-entry interval	Comments
High	Telone II	3.0 – 5.0 gal.	Pre-plant fumigant	5 days	Should be injected under the row so that after bedding there are at least 14-inches between the release point and the soil surface. A minimum waiting period of 10 to 14 days is needed prior to planting. Additional materials are needed for thrips control.
High	Temik 15G	3.0 - 6.0 lbs.	Post-emergence side-dressed	48 hrs.	Always use in combination with an at-plant or pre-plant nematicide. Apply after 1st square. Side-dress granules 8 to 16 inches to one side of the plant row and 2 to 6 inches deep.
High	AgLogic 15G	5.0 lbs	Post – emergence side-dressed	48 hours	To control high levels of nematodes, apply as a split application, in-furrow + side dress. Apply side dress in a furrow that is 6 to 12 inches to one or both sides of the plant row to a depth of 2 to 3 inches.
High	K-Pam	6.0 – 12.0 gal.	Pre-plant fumigant	5 days (see label)	Inject 12 inches below planting depth and seal immediately. Wait 7-14 days before planting
High	Vapam HL	6.0 - 12.0 gal.	Pre-plant fumigant	5 days (see label)	Inject 12 inches below planting depth and seal immediately. Wait 7-14 days before planting
Low to Moderate	Velum Total	14 to 18 fl. oz.	In-furrow At-plant	12 hrs.	Apply as in-furrow spray with 5 to 6 gal./acre of water at planting. Contains an insecticide-imidacloprid, plus a fungicide/nematicide-fluopyram
Moderate to High	Vydate CLV	8.5 – 17.0 fl. oz.	Post-emergence	48 hrs.	Apply 2- to 4-weeks after emergence as a band over the row or broadcast. Always apply in combination with an at-plant or pre-plant nematicide.
Low to Moderate	Temik 15G	3.0 – 6.0 lbs.	In-furrow at-plant	48 hrs.	Drill granules just below the seed line or place in seed furrow and cover with soil.
Low to Moderate	AgLogic 15G	3.5 to 6.0 lbs.	In-furrow at-plant	48 hrs.	Apply granules in the seed furrow and immediately cover with soil by mechanical means. OR Apply granules in a 4 to 6-inch band (T-Band) over open seed furrow and immediately cover with soil by mechanical means.

NEMATICIDES AVAILABLE IN SOUTH CAROLINA AS COMMERCIAL SEED TREATMENTS FOR CONTROL OF LOW TO MODERATE LEVELS OF NEMATODES. SEE LABELS FOR SPECIFIC SPECIES CONTROLLED BY EACH PRODUCT.

Nematode level	Product	Application Method	Re-entry interval	Comments
Low to Moderate	AERIS Seed-Applied Insecticide/Nematicide	Available only as a commercial seed treatment	Not applicable	Contains a nematicide and an insecticide. See label for further information.
Low to Moderate	Avicta 500 FS	Available only as a commercial seed treatment	Not Applicable	Contains only the nematicide Abamectin.
Low to Moderate	Avicta Duo Cotton	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (Abamectin at 12.4%) and an insecticide (Thiamethoxam at 28.1%). See label for further information.
Low to Moderate	Avicta Duo COT202	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (Abamectin at 11.2%) and an insecticide (Thiamethoxam at 28.0%). See label for further information.
Low to Moderate	PONCHO/VOTiVO	Available only as a commercial seed treatment	Not applicable	Contains a nematicide and an insecticide. See label for further information.

GRASS FORAGE WEED CONTROL

Mike Marshall, Extension Weed Specialist

Newly Sprigged Bermudagrass

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Direx 4L (*diuron*)	0.8-2.4 qt	0.8-2.4 lb	7	70 days	12 hours

Diuron 4L

Comments: Apply DIREX immediately after sprigging to control of annual broadleaves and grasses (up to 4" in height). Add a surfactant at 1 pt per 100 gallons of spray solution. Bermudagrass sprigs should be planted 2 inches deep to minimize chance of injury. Emerged bermudagrass at the time of treatment may be temporarily injured. DIREX is not labeled for use in established bermudagrass hayfields and pastures.

Graslan 3.81L	1.0 pt			30 days	48 hours
(*2,4-D*		0.375 lb	4		
+ *picloram*)		0.10 lb	4		

Comments: GRASLAN is a RESTRICTED USE PESTICIDE. Apply GRASLAN at 1.0 pt/A to sprigged bermudagrass once runners (stolons) have reached 6 inches in length and growing conditions are favorable. *GRASLAN should not be used in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown. Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Outrider 75DF (*sulfosulfuron*)	1.33 oz	0.062 lb	2	14 days	12 hours

Comments: Apply OUTRIDER at 1.33 oz/A to control johnsongrass, yellow and purple nutsedge, and other weeds in newly sprigged bermudagrass hayfields and pastures 4 weeks after emergence of sprigged areas. For best results, do not graze or mow pasture/hayfield 2 weeks before or 2 weeks after application. Addition of NIS at 1 qt/100 gal is required. A follow-up application of OUTRIDER can be made when sufficient weed regrowth is observed, but no sooner than 4 weeks after the previous application.

Surmount 2.15SL	1.5-6.0 pt			0 days	12 hours
(*picloram*		0.22-0.9 lb	4		
+ *fluroxypyr*)		0.18-0.72 lb	4		

Comments: SURMOUNT is a RESTRICTED USE PESTICIDE. *Do not use SURMOUNT in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown.* Apply at 1.5 pt/A to sprigged bermudagrass once runners (stolons) have reached 6 inches in length and growing conditions are favorable. Do not apply more than 3 qt/A per year. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Newly Sprigged Bermudagrass (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
2,4-D 4SL amine/ester	1.0-2.0 qt	1.0-2.0 lb ae	4	7 days	48 hours

Comments: Apply 2,4-D to emerged broadleaf weeds 3-4 inches tall. Apply 1 lb ae/A for susceptible annual and biennial broadleaves and 2 lb ae/A for difficult-to-control broadleaf biennials and perennials. Apply low volatile esters from October through March. Use only non-volatile AMINE formulations from late March through September. Do not apply more than 2.0 qt per acre per season. Do not make more than 2 applications per year. Minimum interval between sequential applications is 30 days. For best results, apply to thistles when they are in the rosette stage of growth (less than 3 inches). *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Established Dormant Warm Season Forage Grass Pastures and Hayfields

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL 2 SL (*paraquat*)	1.0-2.0 pt	0.25-0.50 lb	22	40 days	12 hours
Parazone 3SL Firestorm 3SL	0.7-1.3 pt	0.26-0.49 lb			

Comments: GRAMOXONE SL is a RESTRICTED USE PESTICIDE. Apply in a minimum of 10 gallons of water in late winter or early spring (February or March) before bermudagrass breaks dormancy and begins spring green-up. Add 1 pt NIS per 100 gal. of spray mix. Do not mow for hay until 40 days after treatment. Do not make more than 3 applications per year.

Glyphosate *acid equivalent (ae)*			9	21 days	12 hours
4.5 lb ae/gal	8-11 oz	0.28-0.38 lb ae			

Comments: Apply in early- to late-winter months to early spring (prior to green-up) in bermudagrass pastures to control winter weeds. Apply before bermudagrass exhibits new growth in the spring. Some stunting will occur when applications are made when crop is not dormant. Only one application of GLYPHOSATE is permitted per year. If a spring application prior to growth initiation was made, then an application following the first cutting may not be made in the same year.

Prowl H_2O 3.8CS	1.1-4.2 qt		3	0 days	24 hours
(*pendimethalin*)		1.1-4.0 lb			

Comments: Apply PROWL H_2O in late-February to mid-March in early spring to dormant bermudagrass, bahiagrass, and switchgrass pastures. Apply before any new growth appears in the spring. Provides residual control of crabgrass, sandburs, and pigweed. PROWL H2O may be applied in two split applications with the first half at the onset of winter dormancy and the remainder in early spring before green-up. Do not apply more than 4.2 qt/A of PROWL H2O in any one cropping season.

Permanent and Established Forage Grass Pastures and Hayfields

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2 EC (*carfentrazone*)	0.5-2.0 fl oz	0.008-0.032 lb	14	0 days	12 hours

Aim 1.9 EW

Comments: Apply AIM in a minimum of 25 gallons of finished spray solution with ground equipment to control broadleaf weeds up to 4 inches tall including bitter sneezeweed, cocklebur, woolly croton, buttercup, and dogfennel. Add a nonionic surfactant at 1 qt/100 gals plus ammonium sulfate at 2.5 lbs/A. May be tank mixed with other herbicides labeled for pasture use. Do not make sequential applications less than 7 days apart. Do not apply more than 5.9 fl oz/A per season. Do not make more than 3 applications per season.

Banvel 4SL (*dicamba*)	1.0-3.0 pt	0.5-1.5 lb	4	30 days	24 hours

Clarity 4SL

Comments: If thistles are present, apply while they are in the rosette stage of growth. This treatment may severely injure or kill clovers, alfalfa, and other legumes. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Chaparral 0.71DF	2.0-3.0 oz			14 days	48 hours
(*aminopyralid*		0.014-0.020 lb	4		
+					
metsulfuron)		0.002-0.003 lb	2		

Comments: Apply CHAPARRAL at 2.0 oz/A to control most broadleaf species common in bermudagrass pastures and hayfields. Add a NIS at 1 qt per 100 gallons of spray solution *or* COC at 1 gallon per 100 gal spray solution *plus* ammonium nitrogen fertilizer at 2 qt/A or spray grade ammonium sulfate at 2 lb/A. Do not plant a broadleaf crop until conducting a field bioassay. CHAPARRAL will kill legume crops such as clovers or alfalfa. Do not exceed 3.3 oz/A per year. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Aminopyralid Hay/Manure Restrictions: Do not use grasses treated with CHAPARRAL in the preceding 18 months for hay intended for export outside of United States. Hay from areas treated with CHAPARRAL in the preceding 18 months CAN NOT be distributed or made available for sale off farm or ranch where harvested. Hay from areas treated with CHAPARRAL in the preceding 18-months CAN NOT be used for silage, baylage, haylage, and green chop. Do not move hay made from grass treated with CHAPARRAL within the preceding 18-months off farm. Do not use hay or straw from areas treated with CHAPARRAL within the preceding 18-months or manure from animals feeding on hay treated with CHAPARRAL in compost. Do not use grasses treated with CHAPARRAL in the preceding 18 months for seed production.

Cimarron Max 3SL				37 days	48 hours
(*metsulfuron*	0.25-1.0 oz	0.009-0.037 lb	2		
+					
dicamba	1.0-4.0 pt	0.25-0.5 lb	4		
+					
2,4-D)		0.72-1.44 lb	4		

Comments: CIMARRON MAX is a 2 part (Part A – metsulfuron; Part B – dicamba + 2,4-D) product used for annual and perennial broadleaf weed control in bermudagrass pastures. Desirable broadleaf forage plants, such as clover or alfalfa, may be severely injured or killed. Apply with NIS (1 qt/100 gal) or COC (1 gal/100 gal) plus nitrogen fertilizer at 2 qt/A (UAN) or 2 lb/A (AMS). *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Cimarron Plus 63DF	0.125-1.25 oz			0 days	4 hours
(*metsulfuron*		0.004-0.038 lb	2		
+		+			
chlorsulfuron)		0.001-0.011 lb	2		
Chisum 63DF					

Comments: Apply CIMARRON PLUS to established bermudagrass for the control of 'Pensacola' bahiagrass and certain broadleaf weeds. Add 1.0 pt to 1.0 qt nonionic surfactant per 100 gal. of spray mix. Not effective for the control of 'Common' or 'Argentine' bahiagrass. Desirable broadleaf forage plants, such as clover or alfalfa, may be severely injured or killed.

Crossbow 3SL	1.0-4.0 qt			14 days	**
(*2,4-D*		0.5-2.0 lb	4		
+					
triclopyr)		0.25-1.0 lb	4		

Comments: Apply CROSSBOW to control broadleaf weeds and woody plants. Desirable forage broadleaf plants such as clover or alfalfa may be killed if sprayed. For range and pasture sites, do not apply more than 1 gallon CROSSBOW per acre per season. Do not make more than 1 application per year in rangeland and pasture areas. *Do not make applications when circumstances favor movement from treatment site to sensitive areas. **Do not enter or allow others to enter treated area until sprays have dried completely.*

Garlon 3A (*triclopyr*)	2.0-5.0 pt	0.75-1.88 lb ae	4	14 days	48 hours

Comments: Apply GARLON 3A to established grass pastures for control of broadleaf weeds and woody brush. TreatDesirable forage broadleaf plants such as clover or alfalfa may be killed if sprayed. Applications at air temperatures >85°F may cause moderate to severe bermudagrass injury for two to three weeks. Do not apply more than 2.0 lb ae/A of GARLON 3A per growing season. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Graslan 3.81SL	0.67-2.67 pt			21 days	48 hours
(*2,4-D choline*		0.38-1.0 lb	4		
+					
picloram)		0.07-0.27 lb	4		

Comments: GRASLAN is a RESTRICTED USE PESTICIDE. Apply GRASLAN at 2.67 pt/A or less to control broadleaf weeds permanent grass pastures that will be over-seeded with grasses (annual ryegrass, wheat, rye, oats, or tall fescue). Use higher rate for larger weeds and heavier infestations. Site should be left undisturbed for 21 days after application. Apply GRASLAN at 5.0 pt/A for control of prickly pear cactus, horsenettle, and other woody plants. For permanent pastures that have been over-seeded with ryegrass or small grains, do not apply GRASLAN in excess of 1.0 pt/A and delay application until seedling grasses are well established and at the tiller stage or later. Not recommended for use in rotational systems that utilize broadleaf crops or in temporary summer or winter grazing grass systems unless temporary grass is seeded into a permanent pasture. Do not apply more than 5 qt/A per year. Do not make more than 2 applications per year. Do not apply within 30 days of the previous application. Do not use manure from animals that have grazed treated areas for growing broadleaf crops, ornamentals, orchards, or other susceptible crops. Do not use hay or other plant materials from treated areas or manure from animals being fed treated forage or hay for composting or mulching desirable, susceptible broadleaf crops. *GRASLAN should not be used in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown. Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Glyphosate* *acid equivalent (ae)* 4.5 lb ae/gal.	10 oz	0.35 lb ae	9	21 days	4 hours
Comments: Apply GLYPHOSATE after the first bermudagrass cutting when bermudagrass has not yet initiated regrowth. Controls crabgrass, field sandbur, seedling johnsongrass and most annual grasses. Applications made after regrowth has begun will injure bermudagrass. Only one application of GLYPHOSATE is permitted per year. If a spring application prior to growth initiation and application following the first cutting may not be made in the same year.					
GrazonNext HL 3.74SL (*aminopyralid* + *2,4-D*)	1.2-2.1 pt 	 0.06-0.11 lb 0.50-0.87 lb	 4 4	7 days	48 hours
Comments: Controls annual and perennial broadleaf weeds as listed for MILESTONE. Add a nonionic surfactant at 0.25% v/v. Do not plant a broadleaf crop until conducting a field bioassay. GRAZONNEXT HL will kill legume crops such as clovers or alfalfa. Do not apply more than 2.1 pt/A per season. Do not make more than 2 applications per year. Do not apply within 30 days of previous application. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.* **Aminopyralid Hay/Manure Restrictions:** Do not use grasses treated with GRAZONNEXT HL in the preceding 18-months for hay intended for export outside the United States. Hay from areas treated with GRAZONNEXT HL in the preceding 18 months cannot be distributed or made available for sale off the farm or ranch where harvested. Do not move hay made from grass treated with GRAZONNEXT HL within the preceding 18 months off farm. Do not use hay or straw from areas treated with GRAZONNEXT HL or manue from animals feeding on hay treated with GRAZONNEXT HL in compost. Do not use the grasses treated with GRAZONNEXT HL in the preceding 18 months for seed production.					
Impose 2SL (*imazapic*) Panoramic 2SL	4-12 oz	0.063-0.188 lb	2	0 days	12 hours
Comments: Apply 4-6 oz/A for summer annual broadleaf and grass weeds and 6-12 oz/A for perennial grass weeds. Bermudagrass growth may be suppressed for 30-45 days after application. Do not apply to drought stressed bermudagrass. Add a NIS (1 qt/100 gal) or MSO at 1.5-2.0 pt/A to the spray mix. Do not apply during transition from dormancy to full green-up. Do not use on newly sprigged or seeded bermudagrass. Apply IMPOSE or PANORAMIC in 10-20 gal/A nitrogen fertilizer (28-32% N) as a spray carrier will shorten the recovery time.					
Metsulfuron 60DF (*metsufluron*) Accurate 60DF	0.1-0.4 oz	0.004-0.015 lb	2	0 days	4 hours
Comments: Apply 0.1-0.4 oz/A for control of summer annual and perennial broadleaf weeds. Add a nonionic surfactant at 1 qt per 100 gal of spray solution. METSULFURON may be tank mixed with 2,4-D (ester formulations preferred), BANVEL, GRAZON P+D, REMEDY, TORDON 22K, or WEEDMASTER.					

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Milestone 2S (*aminopyralid*)	3.0-7.0 oz	0.047-0.109 lb	4	14 days	48 hours

Comments: Controls annual and perennial broadleaf weeds, including invasive and noxious weeds. Add a nonionic surfactant at 1 qt/100 gal. Do not plant a broadleaf crop until conducting a field bioassay. Do not apply more than 7 fl oz/acre of MILESTONE per year. MILESTONE will kill legume crops such as clovers or alfalfa. Do not use MILESTONE on grasses grown for seed production. Hay from grass treated with MILESTONE within the preceding 18 months can only be used on the farm or ranch where the product is applied*. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Aminopyralid Hay/Manure Restrictions: Do not use grasses treated with AMINOPYRALID in the preceding 18 months for hay intended for export outside the United States. Hay from areas treated with AMINOPYRALID in the preceding 18 months can not be distributed or made available for sale off the farm or ranch where harvested. Hay from areas treated with AMINOPYRALID can not be used for silage, baylage, or green chop. Do not move hay from grass treated with AMINOPYRALID within the preceding 18 months. Do not use hay or straw from areas treated with AMINOPYRALID within the preceding 18 months or manure from animals feeding on hay treated with AMINOPYRALID in compost. Do not use grasses treated with AMINOPYRALID in the preceding 18 months for seed production.

Outrider 75DF (*sulfosulfuron*)	1.33-2.0 oz	0.047-0.094 lb	2	14 days	12 hours

Comments: Apply OUTRIDER at 1.33 oz/A from early spring through fall to control johnsongrass (minimum of 18-24 inches tall), yellow and purple nutsedge, and other weeds in bahiagrass and bermudagrass hayfields and pastures. A follow-up application can be made 40 days after last application. For control of large weeds or when weed growth is heavy or dense, a single application of 2.0 oz/A is permitted. For best results, do not graze or mow pasture/hayfield 2 weeks before or 2 weeks after application. Addition of NIS at 1 qt/100 gal is required. No crop, except wheat, may be planted into a treated pasture within 12 months of application.

Pastora 71.2DF	1.0-1.5 oz			0 days	4 hours
(*nicosulfuron*		0.035-0.053 lb	2		
+		+			
metsulfuron)		0.009-0.014 lb	2		

Comments: Apply PASTORA to *bermudagrass hayfields and pastures* anytime during the growing season for control of sandburs, crabgrass, blackberry, vaseygrass, and Pensacola bahiagrass. Allow at least 16 days between applications of PASTORA. For control of vaseygrass, apply PASTORA at 1.0-1.5 oz/A 7 to 14 days after cutting bermudagrass for hay when vaseygrass has regrown 2-4 inches above the bermudagrass. A repeat application may be necessary for adequate level of control. Do not apply more than 2.5 oz/A of PASTORA per year. Add non-ionic surfactant at 1 qt/100 gal of spray solution plus nitrogen fertilizer at 2 qt/A or a spray grade AMS at 4 lb/A. There is no grazing or haying restrictions after using PASTORA.

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Pastora 71.2DF	1.0-1.5 oz			0 days	4 hours
(*nicosulfuron* + *metsulfuron*) + Glyphosate* *acid equivalent (ae)*	4.0-6.0 fl oz	0.035-0.053 lb + 0.009-0.014 lb + 0.14-0.21 lb ae	2 + 2 + 9		
4.5 lb ae/gal.					
Comments: For improved control of crabgrass, sandburs, foxtails, rescuegrass, little barley, and ryegrass, tank mix PASTORA with GLYPHOSATE and apply to *bermudagrass hayfields and pastures*. A repeat application may be necessary for adequate level of control. Allow at least 14 days between applications of PASTORA plus GLYPHOSATE. Do not apply more than 2.5 oz/A of PASTORA per year. Add non-ionic surfactant at 1 qt/100 gal of spray solution. Applications of PASTORA plus GLYPHOSATE may result in temporary stunting or yellowing of bermudagrass.					
PastureGard HL 4SL	1.5-8.0 pt			14 days	12 hours
(*triclopyr* + *fluroxypyr*)		0.3-1.5 lb + 0.1-0.5 lb	4 + 4		
Comments: Controls a wide range of herbaceous and woody broadleaf plants. Use 1.5 to 3.0 pts./acre for herbaceous broadleaf weeds. Use 2.0 to 8.0 pts./acre for woody brush and trees. Do not graze lactating dairy animals on treated areas during the same growing season following application. Withdraw meat animals from treated forage at least 3 days before slaughter. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*					
Prowl H2O 3.8CS (*pendimethalin*)	1.1-4.2 qt	1.0-4.0 lb	3	0 days	24 hours
Cool-Season Forage Grasses Comments: Apply PROWL H_2O before target weed germination during the fall after the last cutting, in winter, in spring, or in-season between cuttings. PROWL H2O will not control emerged weeds. Do not apply PROWL H2O to mixed stands of cool-season forage grasses with other forage legumes besides alfalfa. Provides residual control of crabgrass, sandburs, and pigweed. Do not apply more than 4.2 qt/A of PROWL H2O in any one cropping season. Do not apply Prowl H2O to areas where standing water is present in the field. There is no prehavest interval following a PROWL H2O application and livestock grazing or forage harvest.					
Warm-Season Forage Grasses Comments: Apply PROWL H_2O before target weed germination during the fall after the last cutting, during dormancy period or in early spring before greenup, or in-season between cuttings. PROWL H2O will not control emerged weeds. Do not apply PROWL H2O to bermudagrass and bahiagrass after greenup in the spring before the first cutting. Provides residual control of crabgrass, sandburs, and pigweed. For residual control of sandburs through the growing season, consider applying PROWL H2O in a split application with the first half (1-2 qt) at the end of the dormant season and the remainder (1-2 qt) in mid-summer following a cutting. Do not apply more than 4.2 qt/A of PROWL H2O in any one cropping season. Do not apply Prowl H2O to areas where standing water is present in the field. There is no prehavest interval following a PROWL H2O application and livestock grazing or forage harvest.					

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Redeem R&P 3S	1.5-4.0 pt			14 days	48 hours
(*triclopyr*		0.38-1.12 lb	4		
+					
clopyralid)		0.14-0.38 lb	4		

Comments: Apply for control of broadleaf weeds. Use 2.5 to 4.0 pts./acre to control dogfennel, spiny amaranth, and horsenettle. Desirable forage broadleaf plants such as clover or alfalfa may be killed if sprayed. Do not apply to newly-seeded or sprigged grasses until they are well established. Do not transfer livestock from treated grazing areas onto broadleaf crop areas without first allowing 7 days of grazing of untreated grass pasture. Do not use grass from treated areas or manure from animals being fed treated forage for composting or mulching of desirable, susceptible broadleaf plants. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Remedy Ultra 4S	1.0-2.0 pt			14 days	**
(*triclopyr*)		0.5-1.0 lb	4		

Comments: Apply to established grass pastures for control of broadleaf weeds and woody brush. REMEDY ULTRA may be tank-mixed with 2,4-D for broader spectrum weed control and control of sensitive herbaceous species. Desirable forage broadleaf plants such as clover or alfalfa may be killed if sprayed. Applications at air temperatures >85°F may cause moderate to severe bermudagrass injury for two to three weeks. Do not apply more than 0.5 gal/A of REMEDY ULTRA per growing season. *Do not make applications when circumstances favor movement from treatment site to sensitive areas. **Do not enter or allow others to enter treated area until sprays have dried completely.*

Sandea 75DF	0.67-1.33 oz	0.031-0.62 lb	2	37 days	12 hours
(*halosulfuron-methyl*)					

Comments: Apply SANDEA to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply SANDEA at the 3 to 5 leaf growth stage. Temporary crop stature reduction may occur after application of SANDEA if millet is under stress. Apply SANDEA in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Avoid applications when weeds are under drought or heat stress. Do not make more than 2 applications or 1.33 oz/A of SANDEA in a 12-month period. Do not harvest green or dry forage within 37-days application. Animals are permitted to graze fields immediately following applications of SANDEA. **Rainfast interval 4 hours.**

Stinger 3S	0.5-1.33 pt			0 days	12 hours
(*clopyralid*)		0.19-0.50 lb	4		

Comments: STINGER controls numerous annual, biennial, and perennial broadleaves. Consult label for specific weed spectrum. Legumes including alfalfa and clovers will be severely injured or killed by STINGER. Do not apply to newly seeded pasture grasses until they are well established as evidenced by tillering and establishment of secondary root system. Do not use hay or straw cut from treated areas for composting or mulching on broadleaf crops. Do not apply more than 1.33 pt/A per growing season. *Do not make applications when circumstances favor movement from treatment site.*

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Surmount 2.15SL	1.5-6.0 pt			**	12 hours
(*picloram*		0.22-0.9 lb	4		
+					
fluroxypyr)		0.18-0.72 lb	4		

Comments: SURMOUNT is a RESTRICTED USE PESTICIDE. *Do not use SURMOUNT in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown.* Controls a wide range of herbaceous and woody broadleaf plants. Use 1.5 to 2.0 pt/A for herbaceous broadleaf weeds. Use 3.0 to 6.0 pt/A for woody brush and trees. Do not apply more than 3 qt/A per season of SURMOUNT. Do not transfer livestock from treated grazing areas onto broadleaf crop areas without first allowing 7 days of grazing of untreated grass pasture. Do not move treated soil, or use treated soil for growing other plants until soil residues of picloram are no longer detectable by chemical assay. Do not use grass from treated areas or manure from animals being fed treated forage for composting or mulching of desirable, susceptible broadleaf plants. *Do not make applications when circumstances favor movement from treatment site. **14 days for lactating dairy animals; 0 days for all other animal types.*

Telar XP 75DF	0.25-1.0 oz			0 days	4 hours
(*chlorsulfuron*)		0.012-0.047 lb	2		

Comments: TELAR XP is effective on dewberry, blackberry, pigweeds, and radish. Do not apply more than 0.5 oz/A on Tall Fescue, Bluestems, or Switchgrass. Fescues may exhibit temporary stunting or yellowing after TELAR application. Do not apply TELAR over ryegrass (annual or Italian). Do not apply more than 1.3 oz/acre/year of TELAR XP. No grazing or haying restrictions following TELAR XP application.

Velpar 2SL	2.75-4.5 pt			60 days	48 hours
(*hexazinone*)		0.68-1.13 lb	5		
Velpar 75DF	0.9-1.5 lb				

Comments: Controls smutgrass in established bermudagrass and bahiagrass pastures and hayfields. Use low rate on coarse sandy soils, and high rate on fine-textured soils. VELPAR will moderately to severely injure bermudagrass and may eliminate the first cutting of hay. Bahiagrass and bermudagrass will recover from temporary burn and yellowing within two to four weeks of application. Use only on bermudagrass and bahiagrass that have been established one year or more. Do not apply VELPAR near oak trees.

Weedmaster 3.87SL	1.0-4.0 pt			37 days	48 hours
(*2,4-D*		0.72-1.44 lb	4		
+					
dicamba)		0.25-0.5 lb	4		

Comments: For control of a broad spectrum of weeds, apply in late spring or early summer to annual or perennial broadleaf weeds before flowering. If thistles are present, apply while they are in the rosette stage of growth. For horsenettle, use 4.0 pt/A rate. WEEDMASTER may severely injure or kill clovers or alfalfa. *Do not make applications when circumstances favor movement from treatment site.*

Permanent and Established Forage Grass Pastures and Hayfields (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Yukon 67.5WSG (*halosulfuron-methyl* + *dicamba*)	4.0-8.0 oz	0.031-0.077 lb + 0.14-0.28 lb	2 + 4	37 days	24 hours

Comments: Apply YUKON to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply YUKON at the 3 to 5 leaf growth stage. Use higher rate for larger weeds and/or higher field infestations. Apply YUKON in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Crop oil concentrate at 1 gal per 100 gal of spray solution may be substitutied for NIS. Nitrogen fertilizer (AMS or UAN) at 2-4 lb per acre may improve YUKON efficacy on difficult to control weeds. Do not apply YUKON using nitrogen fertilizer as the total carrier or severe crop injury may occur. To maximize control of perennial nutsedge (purple and yellow), two applications may be required to areas in the treated field where nutsedge has emerged or regrown since the last application. Avoid applications when weeds are under drought or heat stress. Do not make more than 2 applications per 12-month period. Do not harvest green or dry forage within 37 days of application. Dairy animals are permitted to graze fields immediately following applications of YUKON. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

2,4-D 4L *amine or low volatile ester*	2.0-4.0 pt	1.0-2.0 lb	4	7 days	48 hours

Weedar 64 3.8S

Comments: Apply 2,4-D to emerged broadleaf weeds 3-4 inches tall. Apply 1 lb ae/A for susceptible annual and biennial broadleaves and 2 lb ae/A for difficult-to-control broadleaf biennials and perennials. Apply low volatile esters from October through March. Use only non-volatile AMINE or ACID formulations from late March through September. Do not apply more than 2.0 qt per acre per season. Do not make more than 2 applications per year. Minimum interval between sequential applications is 30 days. If thistles are present, apply while they are in the rosette stage of growth. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Spot Treatments in Established Forage Grass Pastures and Hayfields

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Arsenal 2SL (*imazapyr*)	2.0-48.0 fl oz	0.03-0.75 lb	2	7 days	48 hours

Comments: Apply ARSENAL for control of undesirable broadleaves and grasses in permanent grass pastures using approved ground application methods (see label). Spot applications to grass pastures using ARSENAL cannot exceed 10% of the area to be grazed or cut for hay. Do not apply more than 48 fl oz of ARSENAL per acre per year.

Spike 20P (*tebuthiuron*)	10-20 lb (3/8-3/4 oz per 100 ft²)	2-4 lb	7	1 year (hay)	--

Comments: Apply SPIKE for control of woody vegetation such as trees, shrubs, and vines in permanent grass pastures. Recommended time for a SPIKE application is during the dormant season prior to woody vegetation growth which minimizes the injury on desirable forage grasses. Spot applications to grass pastures using SPIKE cannot exceed 10% of the area to be grazed or cut for hay.

Temporary Forage Grasses (i.e., Millet, Forage Sorghum, Annual Ryegrass)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Atrazine 4L (*atrazine*)	1.0-2.0 qt	1.0-2.0 lb	5	45 days	12 hours
Comments: *Labeled for forage sorghum/sudangrass hybrids*. Apply ATRAZINE before weeds exceed 1.5 inches in height and before forage sorghum is taller than 12 inches. Add COC at 1 gallon per acre to the spray mixture. Do not apply this mixture to forage sorghum grown on sands or loamy sands or injury may occur.					
Banvel 4S (*dicamba*)	1.0 pt	0.5 lb	4	30 days	24 hours
Clarity 4L					
Comments: *Labeled for forage sorghum.* Treat broadleaves when small and actively growing (less than 4 inches in height). Do not apply more than 1.0 pt/A of BANVEL to reduce risk of crop injury. *Do not make applications when circumstances favor movement from treatment site.*					
Basagran 4S (*bentazon*)	1.0-2.0 pt	1.0-2.0 lb	6	12 days	48 hours
Comments: *Labeled for forage sorghum.* Treat broadleaves when small and actively growing. Adjust rate according to weed size indicated on the product label. Do not apply more than 2 pt/A per season in forage sorghum. Do not apply to forage sorghum that is heading or blooming. Tank mix partners include ATRAZINE, CLARITY, or MARKSMAN.					
Huskie 2.06EC (*pyrasulfotole* + *bromoxynil*)	13-16 fl oz	0.031-0.039 lb + 0.18-0.22 lb	27 + 6	7 days	24 hours
Comments: HUSKIE is a RESTRICTED USE PESTICIDE. *Labeled for forage sorghum*. Apply to forage sorghum from 3-leaf growth stage up to 12 inches in height. Treat broadleaves when small and actively growing. Do not apply more than 16 fl oz/A per application. Do not apply more than 2 applications of HUSKIE with a season maximum of 32 fl oz/A. Wait a minimum of 11 days between HUSKIE applications. Do not use air induction or flood jet nozzles to apply HUSKIE. Unacceptable crop response may occur if HUSKIE is applied to acreage previously treated with any product containing mesotrione (i.e., LUMAX, LEXAR, CALLISTO). Do not apply HUSKIE in a tank mixture with LORSBAN.					
Sandea 75DF (*halosulfuron-methyl*)	0.5-0.67 oz	0.023-0.031 lb	2	37 days	12 hours
Comments: *Labeled for proso millet*. Apply SANDEA from the 2-leaf to layby stage (before grain head emergence) of proso millet to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply SANDEA at the 3 to 5 leaf growth stage. Temporary crop stature reduction may occur after application of SANDEA if millet is under stress. Apply SANDEA in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Avoid applications when weeds are under drought or heat stress. Do not make more than 1 application of 0.67 oz/A in a 12-month period. Do not harvest green or dry forage within 37 days of application. Animals are permitted to graze fields immediately following applications of SANDEA. **Rainfast interval 4 hours.**					

Temporary Forage Grasses (i.e., Millet, Forage Sorghum, Annual Ryegrass) [cont]

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Yukon 67.5WSG (*halosulfuron-methyl* + *dicamba*)	3.0-4.0 oz	0.029-0.031 lb + 0.10-0.14 lb	2 + 4	37 days	24 hours
Comments: *Labeled for proso millet*. Apply YUKON from the 3- to 5-leaf growth stage of proso millet to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply YUKON at the 3 to 5 leaf growth stage. Temporary crop stature reduction may occur after application of YUKON if millet is under stress. Apply YUKON in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Crop oil concentrate at 1 gal per 100 gal of spray solution may be substitutied for NIS. Nitrogen fertilizer (AMS or UAN) at 2-4 lb per acre may improve YUKON efficacy on difficult to control weeds. Do not apply YUKON using nitrogen fertilizer as the total carrier or severe crop injury may occur. Avoid applications when weeds are under drought or heat stress. Do not make more than 1 application per 12-month period. Do not harvest green or dry forage within 37 days of application. Animals are permitted to graze fields immediately following applications of YUKON. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*					
Weedmaster 3.87SL (*2,4-D* + *dicamba*)	1.0 pt	0.72 lb + 0.25 lb	4 + 4	37 days	48 hours
Comments: *Labeled for forage sorghum.* Apply WEEDMASTER to forage sorghum in the 3 to 5 leaf stage of growth (4 to 8 inches tall). For best results, apply when weeds are less than 3 inches tall. Applications during period of rapid growth may result in temporary leaning of plants or rolling of leaves. These effects are usually outgrown in 10 to 14 days. Do not use oils or other surfactants with postemergence applications of WEEDMASTER. Do not make more than 1 postemergence application per crop cycle. Tank mix partners include ATRAZINE, BASAGRAN, and BUCTRIL. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*					
2,4-D 4L *amine or low volatile ester*	0.5-2.0 pt	0.5-1.0 lb	4	**	48 hours
Comments: *Labeled for millet and forage sorghum.* Apply 2,4-D to emerged broadleaf weeds 3-4 inches tall. Apply low volatile esters from October through March. Use only non-volatile AMINE formulations from late March through September. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*					

Forage sorghum: Apply 0.5 to 0.75 lb ae/A postemergence when crop is 6 to 15 inches tall. If forage sorghum is more than 8 inches tall (top of canopy), use drop nozzles to keep spray off foliage. Do not use with oil or other adjuvants. Do not treat during boot, flowering, or dough stage. Do not permit meat or dairy animals to consume treated crop as fodder or forage for 30 days following application. Do not make more than 1 application per crop cycle. ***Preharvest interval for forage sorghum is 30 days*

Millet: Apply 0.5 to 1.0 lb ae/A after crop is fully tillered, but before boot stage of growth (usually 4 to 8 inches tall). Do not apply before tillering or from early boot through milk stage of growth. Do not make more than 1 application per crop cycle. Do not apply more than 1.0 lb ae/A (2 pt/A) per application. For preharvest applications, do not apply more than 0.5 lb ae/A (1 pt/A). ***Preharvest interval for millet is 14 days.*

Interval following herbicide application before grazing, hay cutting, or removal for slaughter

Herbicide	Time Interval (days)[1]				
	Grazing			Removal before Slaughter[3]	Hay Cutting
	Lactating Dairy	Beef	Other Animals[2]		
Arsenal	0	0	0	---	7
Banvel/Clarity					
up to 1 pt/A	7	0	0	30	37
up to 2 pt/A	21	0	0	30	51
up to 4 pt/A	40	0	0	30	70
Chaparral	0	0	0	3	14
Cimarron Max	7	0	0	30	37
Cimarron Plus/Chisum	0	0	0	0	0
Crossbow	Next Growing Season	0	0	3	14
Direx	70	70	70	---	70
Diuron	70	70	70	---	70
Garlon 3A	Next Growing Season	0	0	3	143
GrazonNext HL	0	0	0	3	14
Gramoxone SL	---	---	---	---	40
Glyphosate	---	---	---	---	0
Graslan	7	0	0	3	30
Huskie	7	7	7	---	7
Impose	---	---	---	---	---
Metsulfuron/Accurate	0	0	0	0	0
Milestone[4]	0	0	0	3	14
Outrider	0	0	0	---	14
Panoramic	---	---	---	---	---
Pastora	0	0	0	0	0
PastureGard HL	Next Growing Season	0	0	3	14
Prowl H2O	0	0	0	0	0
Redeem R&P[5]	Next Growing Season	0	0	3	14[6]
Remedy Ultra	Next Growing Season	0	0	3	14
Sandea	0	0	0	0	37
Spike	0	0	0	---	365
Stinger[5]	0	0	0	---	0
Surmount[7]	14	0	0	3	0[8]
Velpar	60	60	60	---	60
Weedmaster	7	0	0	30	37
Yukon	0	0	0	0	37
2,4-D (various)	7	0	0	3	7

[1]--- no information provided by the label.

[2]Other animals include goats, horses, and sheep.

[3]For the removal period indicated animals for slaughter should be withdrawn from treated areas or consumption of hay harvested from treated areas.

[4]Do not use or transfer treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed forage or eaten hay harvested from treated areas within the previous 3 days, in compost or mulch that will be spread to areas where broadleaf crops may be grown. Manure from animals that have grazed forage or eaten hay harvested from treated areas within the past 3 days may only be used pasture grasses, grass grown for seed, and wheat.

[5]Do not transfer livestock from treated grazing areas (or feeding of treated hay) to sensitive broadleaf crop areas without first allowing 7 days of grazing in an untreated area (or feeding of untreated hay), manure and urine may contain enough clopyralid to cause injury to sensitive broadleaf crops

[6]Do not harvest hay from the treated area until the next growing season for consumption by lactating dairy cattle.

[7]Do not transfer livestock from treated grazing areas (or feeding of treated hay) to sensitive broadleaf crop areas without first allowing 7 days of grazing in an untreated area (or feeding of untreated hay), manure and urine may contain enough picloram to cause injury to sensitive broadleaf crops

[8]Do not harvest hay from treated area for consumption by lactating dairy animals within 14 days after application.

Plant-back restrictions following herbicide application in grass forages

Herbicide	Time Interval (months)				
	Clovers[1]	**Wheat**	**Oats**	**Tall Fescue**	**Annual Ryegrass**
Arsenal	12 + Soil Assay[10]	12 + Soil Assay[10]	12 + Soil Assay[10]	12 + Soil Assay[10]	12 + Soil Assay[10]
Banvel/Clarity	12	4	4	4	4
Chaparral	Soil Assay[9]	0	12	0	4
Cimarron Max	4	1	10	4	4
Cimarron Plus/Chisum	4	1	10	4	4
Crossbow	Soil Assay[7]	3 weeks	3 weeks	3 weeks	3 weeks
Garlon 3A	Soil Assay[7]	3 weeks	3 weeks	3 weeks	3 weeks
Glyphosate	None indicated on label				
GrazonNext HL	Soil Assay[2]	4	4	4	4
Graslan	Soil Assay[5]	2[4]	2[4]	Soil Assay[5]	Soil Assay[5]
Huskie	Soil Assay[9]	1	1	1	1
Impose					
<4 oz/A	26	12	18	26	26
5-8 oz/A	30	12	22	30	30
9-12 oz/A	36	12	24	36	36
Metsulfuron/Accurate	Soil Assay[9]	1	10	18	6
Milestone[4]	Soil Assay[2]	Fall[3]	Fall[3]	Fall[3]	Fall[3]
Outrider	12	0	12	12	12
Panoramic					
<4 oz/A	26	12	18	26	26
5-8 oz/A	30	12	22	30	30
9-12 oz/A	36	12	24	36	36
Pastora	12	4	10	4	4
PastureGard HL	1	4	4	3 weeks	3 weeks
Prowl H2O	12	4	12	10	10
Redeem R&P	Soil Assay[6]	0	0	Soil Assay[6]	Soil Assay[6]
Remedy Ultra	Soil Assay[7]	3 weeks	3 weeks	3 weeks	3 weeks
Sandea	9	2	2	2	2
Spike	24	24	24	24	12
Stinger	Soil Assay[6]	0	0	0	0
Surmount	12[8]	0	0	0	0
Velpar	None indicated on label				
Weedmaster	4	4	4	4	4
Yukon	9	2	2	2	2
2,4-D (various)	12	4	4	4	4

[1]Clover species include red, white, and sweet.
[2]Do not plant forage legumes until a soil assay has been conducted to determine if aminopyralid residues remaining in the soil will adversely affect establishment.
[3]If GRAZONNEXT HL or MILESTONE is applied in the spring or early summer, grasses may be planted the following fall when conditions are favorable for grass establishment.
[4]Wait 60 days or 2 months with temperatures above 40 F during that period.
[5]Do not plant any crop except small grains until a soil assay has been conducted to determine if picloram residues remaining in the soil will adversely affect rotational crop establishment.
[6]Do not plant a rotational crop until a soil assay has been conducted and shows that no clopyralid residues remain in the soil.
[7]Do not plant forage legumes until a soil assay has been conducted to determine if triclopyr residues remaining in the soil will adversely affect legume establishment.
[8]After 12 months, a soil assay should be conducted before seeding forage legumes to verify no picloram residues remain in the soil.
[9]Do not plant forage legumes until a soil assay has been conducted to determine if herbicide residues remaining in the soil will adversely affect legume establishment.
[10]Following 12 months after ARSENAL application and before planting any crop, a successful field bioassay must be completed. See label for more information.

Weed Response[1] to Herbicides Used in Forage Grasses

	Lifecycle[2]	Prowl H2O	Banvel/Clarity	Chaparral	Cimarron MAX	Cimarron Plus	Crossbow	Glyphosate	Gramoxone SL	GrazonNext HL	Grasalan	Impose/Panoramic	Metsulfuron	Milestone
amaranth, spiny	A	FG	GE	E	E	E	E	E	F	E	GE	G	E	G
apple, tropical soda	P	P	FG	E	P	P	F	P	P	E	GE	P	P	E
bahiagrass	P	P	P	G	FG	G	P	FG	P	P	P	PF	G	P
barley, little	A	P	P	P	P	P	P	GE	FG	P	P	---	P	P
bedstraw, smooth	A	F	P	G	P	P	G	G	F	E	E	G	P	E
blackberry/dewberry	P	P	FG	GE	F	GE	G	P	PF	P	F	P	GE	G
broomsedge	P	P	P	P	P	P	P	FG	P	P	P	P	P	P
boneset, lateflower	P	---	G	---	---	---	G	G	F	---	G	---	---	---
bullrush	P	P	G	---	---	---	GE	P	P	P	---	---	---	P
buttercup	A	P	P	GE	E	E	E	FG	G	E	E	---	E	GE
carrot, wild	B	P	---	G	---	G	---	FG	G	FG	GE	G	G	FG
cheat	A	G	P	P	P	P	P	E	G	P	P	G	P	P
chickweed, common	A	F	E	E	E	E	F	G	E	F	F	---	E	F
cocklebur, common	A	P	E	E	E	E	E	E	G	E	E	---	E	E
crabgrass	A	G	P	P	P	P	P	E	F	P	P	E	P	P
croton, woolly	A	P	E	GE	E	G	E	P	P	E	E	---	G	E
cudweed	A	P	E	G	G	G	E	P	P	E	G	---	---	E
dallisgrass	P	P	P	P	P	P	P	GE	P	P	P	F	P	P
dandelion	P	P	E	GE	GE	GE	E	P	P	GE	E	---	GE	P
dock, curly	P	P	E	E	E	E	G	P	P	E	E	---	E	E
dodder	A	P	P	---	---	---	P	P	G	---	---	---	---	---
dogbane, hemp	P	P	F	P	P	P	FG	P	P	P	F	---	---	P
dogfennel	P	P	FG	P	F	F	E	P	P	G	G	---	F	PF
eveningprimrose, cutleaf	A	P	E	G	G	G	E	F	PF	E	E	---	G	E
falsedandelion, Carolina	B	P	E	GE	GE	GE	E	P	P	GE	E	---	GE	P
foxtail, knotroot	P	P	P	P	P	P	P	FG	P	P	P	PF	P	P
foxtail, yellow	A	F	P	P	P	P	P	G	F	P	P	FG	P	P
garlic, wild	P	P	E	G	GE	G	---	P	E	G	F	---	G	P
geranium, Carolina	A	P	---	G	G	---	---	P	P	E	E	---	---	E
goldenrod	P	P	G	P	P	P	G	P	P	G	G	---	P	G
goosegrass	A	G	P	P	P	P	P	E	F	P	P	E	P	P
greenbriar (smilax)	P	P	F	---	---	---	P	P	P	G	---	---	P	---
henbit	A	FG	G	GE	E	E	F	F	G	F	PF	---	E	FG
honeysuckle	P	P	E	---	---	---	E	P	P	F	---	---	---	---
horsenettle	P	P	G	E	F	PF	PF	P	P	E	GE	P	PF	E
horseweed	A	P	E	G	F	F	G	G	P	E	E	P	F	E

[1]Key to Response Ratings*:* E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data.

[2]Abbreviations: A = Annual; B = Biennial; P = Perennial.

Weed Response[1] to Herbicdes Used in Forage Grasses (cont)

	Lifecycle[2]	Prowl H2O	Banvel/Clarity	Chaparral	Cimarron MAX	Cimarron Plus	Crossbow	Glyphosate	Gramoxone SL	GrazonNext HL	Grasalan	Impose/Panoramic	Metsulfuron	Milestone
johnsongrass	P	FG	P	P	P	P	P	E	FG	P	P	G	P	P
kudzu	P	P	G	G	PF	PF	FG	P	P	G	F	P	PF	G
lespedeza, sericea	P	P	P	P	FG	GE	PF	P	P	---	P	---	GE	---
lettuce, prickly	B	P	---	E	---	---	---	FG	---	E	E	F	---	E
mint, perilla	A	P	GE	GE	G	---	GE	---	FG	GE	E	---	---	P
nutsedge	P	P	P	P	P	P	P	FG	PF	P	P	GE	P	P
orange, trifoliate	P	---	---	GE	---	---	---	F	P	---	---	---	---	GE
palmetto	P	P	F	P	P	P	---	P	P	---	---	P	P	P
panicum, Texas	A	FG	P	P	P	P	P	GE	G	P	P	PF	P	P
passionflower, maypop	P	P	P	P	P	P	P	P	P	P	F	P	P	P
pear, prickly	P	P	F	P	P	P	---	PF	P	P	P	P	P	P
pepperweed, Virginia	A	FG	E	---	---	---	---	---	G	G	E	---	---	P
persimmon	P	P	G	---	P	P	G	---	P	P	F	P	---	P
pigweeds	A	FG	E	E	E	E	E	E	G	E	G	G	E	E
plantains	P	P	E	E	E	E	G	---	P	G	FG	G	E	P
pokeweed, common	P	P	E	P	---	P	G	PF	P	G	F	---	F	F
radish, wild	A	P	E	GE	GE	GE	E	FG	P	G	---	E	GE	P
ragweed, common	A	P	E	E	G	G	E	FG	G	E	E	F	G	E
rescuegrass	A	---	P	P	P	P	P	G	F	P	P	---	P	P
rose, Cherokee	P	P	---	GE	---	---	---	---	P	E	FG	P	---	GE
ryegrass, annual	A	G	P	P	P	P	P	GE	FG	P	P	F	P	P
sandbur	A	G	P	P	P	P	P	GE	FG	P	P	FG	P	P
shepherdspurse	A	F	E	---	---	---	E	G	G	E	E	E	G	P
sicklepod	A	P	E	G	G	G	E	G	E	GE	E	FG	G	P
sida, arrowleaf	A	P	G	---	G	G	PF	P	P	E	E	F	F	P
sida, prickly	A	P	G	---	G	G	PF	P	P	E	E	F	F	P
smartweed	A	P	G	GE	E	E	GE	G	E	E	E	---	E	E
smutgrass	P	P	P	P	P	P	P	G	P	P	P	P	P	P
sneezeweed, bitter	P	P	E	E	E	E	E	GE	---	E	E	---	---	GE
sorrel, red	P	P	G	E	G	GE	E	FG	PF	E	---	---	E	---
spurge, nodding	A	P	P	P	E	E	P	FG	F	P	P	P	E	P
thistles	B	P	G	E	G	F	E	G	G	E	E	---	F	E
torpedograss	P	P	P	P	P	P	P	G	P	P	P	F	P	P
trumpetcreeper	P	P	FG	P	P	P	P	P	P	P	F	P	P	P
vaseygrass	P	P	P	P	P	P	P	FG	P	P	P	FG	F	P
vervain, blue	P	P	---	---	---	---	---	---	P	G	G	---	---	F

[1]Key to Response Ratings*:* E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; --- =Insufficient data.

[2]Abbreviations: A = annual; B = Biennial; P = Perennial.

Weed Response[1] to Herbicides Used in Forage Grasses (cont)

	Lifecycle[2]	Outrider	Pastora	PastureGard HL	Redeem R&P	Remedy Ultra	Sandea	Stinger	Surmount	Telar XP	Velpar	Weedmaster	Yukon	2,4-D
amaranth, spiny	A	P	GE	PF	P	---	G	---	GE	---	FG	E	GE	FG
apple, tropical soda	P	P	P	G	P	G	P	---	E	---	F	F	FG	P
bahiagrass	P	P	P	P	P	P	P	P	P	---	P	P	P	P
barley, little	A	P	---	P	P	P	P	---	P	---	P	P	P	P
bedstraw, smooth	A	---	P	G	---	P	---	P	G	F	---	P	P	P
blackberry/dewberry	P	P	G	G	GE	GE	P	P	G	GE	F	PF	FG	P
broomsedge	P	P	---	P	P	P	P	P	P	---	P	P	P	P
boneset, lateflower	P	---	---	---	---	---	P	---	---	---	---	G	G	G
bullrush	P	P	---	P	P	G	P	P	GE	---	---	---	G	GE
buttercup	A	P	E	F	E	E	---	---	G	---	G	E	P	E
carrot, wild	B	P	G	---	---	---	---	---	FG	F	---	---	---	---
cheat	A	P	G	P	P	P	P	P	P	P	P	P	P	P
chickweed, common	A	P	E	F	G	E	P	---	GE	---	E	E	E	F
cocklebur, common	A	P	E	GE	GE	G	G	G	E	---	GE	E	E	G
crabgrass	A	P	GE	P	P	P	P	P	P	P	P	P	P	P
croton, woolly	A	P	E	F	F	G	---	---	E	---	P	E	E	GE
cudweed	A	P	GE	G	E	E	---	---	G	---	---	G	E	F
dallisgrass	P	P	FG	P	P	P	P	P	P	P	P	P	P	P
dandelion	P	P	G	GE	G	E	P	G	E	---	E	E	E	E
dock, curly	P	P	GE	F	E	E	P	F	G	---	P	E	E	F
dodder	A	P	---	P	P	P	P	---	---	---	---	PF	P	P
dogbane, hemp	P	P	---	FG	P	F	P	---	G	---	---	F	F	PF
dogfennel	P	P	P	E	GE	GE	P	---	E	---	G	G	FG	FG
eveningprimrose, cutleaf	A	P	F	G	---	E	---	---	E	E	E	E	E	E
falsedandelion, Carolina	B	P	G	GE	G	E	---	---	E	---	E	E	E	E
foxtail, knotroot	P	P	---	P	P	P	P	P	P	P	P	P	P	P
foxtail, yellow	A	P	FG	P	P	P	P	P	P	---	P	P	P	P
garlic, wild	P	P	---	P	---	---	---	P	P	---	---	G	E	GE
geranium, Carolina	A	P	G	---	---	---	---	---	E	---	---	E	---	E
goldenrod	P	P	G	G	G	G	P	---	G	---	---	GE	G	F
goosegrass	A	P	GE	P	P	P	P	P	P	P	P	P	P	P
greenbriar (smilax)	P	P	---	G	P	P	P	---	F	---	F	F	F	P
henbit	A	P	E	GE	G	F	---	---	G	GE	GE	P	G	G
honeysuckle	P	P	---	P	P	PF	P	---	G	---	---	E	E	E
horsenettle	P	P	P	F	F	FG	P	---	E	---	---	F	G	P
horseweed	A	P	---	G	G	G	P	G	E	---	F	E	E	F

[1]Key to Response Ratings*:* E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data.

[2]Abbreviations: A = Annual; B = Biennial; P = Perennial.

Weed Response[1] to Herbicdes Used in Forage Grasses (cont)

	Lifecycle[2]	Outrider	Pastora	PastureGard HL	Redeem R&P	Remedy	Sandea	Stinger	Surmount	Telar XP	Velpar	Weedmaster	Yukon	2,4-D
Johnsongrass	P	E	GE	P	P	P	P	P	P	P	P	P	P	P
Kudzu	P	P	FG	F	F	F	P	---	F	---	---	F	G	PF
lespedeza, sericea	P	---	---	E	---	GE	P	---	---	---	---	P	P	P
lettuce, prickly	B	P	---	---	---	---	P	G	E	---	---	---	---	---
mint, perilla	A	---	---	F	---	FG	---	---	F	---	---	FG	GE	PF
Nutsedge	P	E	P	P	P	P	GE	---	P	P	P	P	GE	P
orange, trifoliate	P	---	---	---	---	GE	P	---	---	---	---	---	---	---
Palmetto	P	---	---	G	P	F	P	---	P	---	P	PF	F	P
panicum, Texas	A	P	GE	P	P	P	P	P	P	P	P	P	P	P
passionflower, maypop	P	P	P	G	F	F	P	P	P	---	---	PF	P	P
pear, prickly	P	P	---	F	P	G	P	---	E	---	P	PF	F	P
pepperweed, Virginia	A	P	---	G	---	P	P	---	G	---	E	E	E	G
Persimmon	P	P	---	F	P	F	P	---	GE	---	F	F	G	P
Pigweeds	A	P	E	F	GE	E	G	P	GE	E	G	E	E	GE
Plantains	P	P	F	F	P	F	P	---	F	---	FG	E	E	E
pokeweed, common	P	P	---	P	P	P	F	---	G	---	---	E	E	G
radish, wild	A	P	GE	GE	F	E	G	---	E	---	E	E	E	G
ragweed, common	A	N	E	E	E	E	G	G	E	---	F	E	E	E
Rescuegrass	A	P	---	P	P	P	P	P	P	P	P	P	P	P
rose, Cherokee	P	N	---	P	---	---	P	---	E	---	---	---	---	---
ryegrass, annual	A	P	GE	P	P	P	P	P	P	F	G	P	P	P
sandbur	A	P	GE	P	P	P	P	P	P	P	P	P	P	P
shepherdspurse	A	P	---	G	G	E	F	---	G	---	E	E	E	E
sicklepod	A	P	E	GE	G	E	P	G	E	G	---	E	E	G
sida, arrowleaf	A	P	---	F	P	P	F	---	E	---	---	E	G	G
sida, prickly	A	P	---	F	P	P	F	---	E	---	---	E	G	G
smartweed	A	P	G	---	---	---	F	---	---	---	FG	G	G	F
smutgrass	P	P	P	P	P	P	P	---	P	P	GE	P	P	P
sneezeweed, bitter	P	P	GE	E	E	E	P	---	E	---	---	E	E	E
sorrel, red	P	P	---	F	FG	E	P	G	E	---	---	G	G	P
spurge, nodding	A	P	E	P	P	P	---	P	P	---	---	P	P	P
thistles	B	P	G	GE	E	E	P	E	GE	---	E	E	G	E
torpedograss	P	---	---	P	P	P	P	P	P	P	P	P	P	P
trumpetcreeper	P	P	P	F	P	F	P	P	P	---	P	P	FG	P
vaseygrass	P	FG	FG	P	P	P	P	p	P	P	P	P	P	P
vervain, blue	P	P	---	---	---	---	P	---	E	---	---	E	---	E

[1]Key to Response Ratings*:* E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data.

[2]Abbreviations: A = annual; B = Biennial; P = Perennial.

PASTURE AND HAY INSECT MANAGEMENT

Jay Crouch, Area Agronomy Agent, Brian Beer, Area Livestock Agent, and Robert Bellinger, Ph.D., Extension Entomologist

Insect pests of *pastures, hay fields and some forage crops are often difficult to notice, and may take growers by surprise. Scout these crops on a regular basis.* For all pests listed, younger, smaller insects are the easiest to control! *Note individual product restrictions and consider control costs carefully.*

Insect resistance management: *Repeated use of certain insecticides can lead to resistance in insect populations Growers are strongly encouraged to rotate products with differing modes of action within a crop year. Consult your product labels and your local Extension Agent for resistance management strategies.* Use the IRAC numbers – different numbers indicate differing modes of action!

Non-Grass Animal Feed (forage, fodder, straw and hay) Group, including alfalfa, various clovers and vetches, other forage legumes see the product labels

ARMYWORMS [True Armyworms *(Pseudaletia unipuncta)***, Fall Armyworms** (*Spodoptera frugiperda*), Yellowstripped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others]

***General Comments*:** For best results apply materials used when larvae are *less* than ½ inch long. Use high spray volume; increase spray *volume (addition of water only)* for large worms and in hot, dry weather. If possible, cut hay before treatment. Apply as late in the day as possible. These species show some resistance to many pesticides. *Check for efficacy after application!*

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin ***R*** Baythroid XL	1.6 – 2.8 fl oz/ac	12 hr	7 d grazing and hay harvest	IRAC Group 3 insecticide Maximum 5.6 fl oz/cutting. Maximum application of 22.4 oz/acre for growing season. *Minimum five (5) days between applications.*
Carbaryl Sevin (various formulations, for example 50WP, 80S)	*See product label*	12 hr	7 d before harvest or grazing for alfalfa, clovers, birdsfoot trefoil 14 d for pasture	IRAC Group 1A insecticide NOTE: Carbaryl has not given acceptable control in some parts of the state. Results on fall armyworm should be carefully noted because of the potential for resistance in this species. See your county agent for local control history. Best to apply 24 – 48 hrs before expected rain because of potential product wash-off. See wash-off resistance information on label (if present.) Numerous formulations of Carbaryl are available. Consult label for use rates.

ARMYWORMS [True Armyworms *(Pseudaletia unipuncta)***, Fall Armyworms** (*Spodoptera frugiperda*), Yellowstripped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others] (cont)

Pesticide	Product/acre	REI	PHI	Comments
Chlorantraniliprole Prevathon	 14-20 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Do not make more than 4 applications per year. Only one application per cutting. Do not apply more than 60 oz/A of Prevathon per year.
Chlorantroniliprole (Rynaxypyr) Coragen	 3.5 – 5.0 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Protect surface waters with buffer zone; recommend apply 48 hrs before expected rainfall. Apply at egg-hatch or when newly hatched larvae are present before damaging populations develop. Maximum application of 15.4 oz/acre per crop. One (1) application per cutting. Maximum four (4) applications per acre per season.
Lambda-cyhalothrin ***R*** Karate, Silencer, others Karate Z	 2.56 – 3.84 oz/ac 1.28 – 1.92 oz /ac	24 hrs 24 hrs	1 d grazing 7 d hay harvest 1 d grazing 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.96 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments. Do not apply more than 0.48 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Lambda-cyhalothrin ***R*** + Chlorantraniliprole Besiege	6.0-9.0 oz/ac	24 hrs	1 d grazing 7 d harvest	IRAC Group 3 and 28 insecticide Do not exceed 31.0 oz/acre/year. Do not apply more than 10 oz/cutting. Apply a minimum of 10 GPA by ground.
Methomyl ***R*** Lannate LV Lannate SP *Water soluble powder in water soluble bags*	 *Alfalfa:*1.5 – 3.0 pts / ac *Alfalfa:* 0.5 – 1 lb / ac	48 hrs	*Alfalfa: Last appl. 7 d before cutting or grazing*	IRAC Group1A insecticide *Read label carefully*! ***Lannate LV****: Alfalfa - See label!* Do not apply more than 12 pts per acre per crop, or make more than 10 applications ***Lannate SP****: Alfalfa - See label!* Do not apply more than 4 lbs per ac per crop or more than 10 applications per crop
Zeta-cypermethrin ***R*** Mustang Max Mustang Max EC Respect	 2.8 – 4.0 oz / ac	12 hr	3 d grazing 3 d hay harvest	IRAC Group 3 insecticide *RUP: toxicity to fish & aquatic organisms.* See label for buffer zones, other info. *Minimum 7 days between applications* ***Maximum season total/ac for non-grass animal feeds*** *(alfalfa, forage, fodder…)* ***is:*** 12.0 oz /ac/season. Note label spray volume recommendations. See label for maximum use when applying both zeta-cypermethrin and cypermethrin products to the same crop within the same season.

GRASSHOPPERS

***General Comments*:** Nymphs easier to kill than adults. May need to apply to grass and field edges.

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin ***R*** Baythroid XL	2.0 – 2.8 oz/ac	12 hr	7 d Pre-harvest/ pre-graze	IRAC Group 3 insecticide Maximum 5.6 fl oz/cutting. Maximum application of 22.4 oz/acre for growing season. *Minimum five (5) days between applications.*
Carbaryl Various Formulations	See Product Label	12 hr	7 d before harvest or grazing for alfalfa, clovers, birdsfoot trefoil 14 d for pasture	IRAC Group 1A insecticide ***Sevin 4F -*** **Note labeled use*: "Pastures and grass grown for seed." Various formulations of Carbaryl are available. Consult label for proper use requirements.
Lambda-cyhalothrin ***R*** Karate, Silencer and others	2.56 – 3.84 oz/ac	24 hrs	1 d grazing 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.96 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Karate Z	1.28-1.92 oz /ac	24 hrs	1 d grazing 7 d hay harvest	Do not apply more than 0.48 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Dimethoate Dimethoate 2.67 Dimethoate 4EC	 0.75 – 1.5 pts/ac 0.5 – 1.0 pt/ac	48 hr	10 d for pasture or hay	IRAC Group 1B insecticide Do not apply when crop or weeds are blooming or bees are foraging Only one application per year Only one (1) application per cutting. Do not apply within 10 days of grazing or cutting
Zeta-cypermethrin ***R*** Mustang Max Mustang Max EC Respect	 2.8 – 4.0 oz /ac	12 hr	3 d grazing 3 d hay harvest	IRAC Group 3 insecticide *RUP: toxicity to fish & aquatic organisms.* See label for buffer zones, other info. *Minimum 7 days between applications* ***Maximum season total/ac for non-grass animal feeds*** *(alfalfa, forage, fodder…)* ***is:*** 12.0 oz /ac/season. Note label spray volume recommendations. See label for maximum use when applying both zeta-cypermethrin and cypermethrin products to the same crop within the same season.

For true armyworm and fall armyworm make applications late in the day. This reduces breakdown of your chemical by daylong exposure to sunlight and puts the most chemical on plants closest to when these species feed.

Grass Forage, Fodder and Hay Group and Grass Grown for Seed and Pasture and Rangeland (see the labels)

ARMYWORMS [True Armyworms *(Pseudaletia unipuncta)***, Fall Armyworms** (*Spodoptera frugiperda*), Yellowstripped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others

***General Comments*:** For best results apply materials used when larvae are *less* than ½ inch long (first and second instar larvae). Use high spray volume; increase spray *volume (addition of water only)* for large worms and in hot, dry weather. If possible, cut hay before treatment. If possible, apply late in the day. These species show some resistance to many pesticides. *Check for efficacy after application!*

Insect resistance management: *Repeated use of certain insecticides can lead to resistance in insect populations. Applicators are encouraged to rotate products with differing modes of action within a crop year. Consult your local Extension Agent for resistance management strategies.*

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin ***R*** Baythroid XL	First two instars true armyworm: 1.6 – 1.9 fl oz/ac First two instars of all other armyworms: 2.6 – 2.8 fl oz/ac	12 hr	0 d grazing and hay harvest	IRAC Group 3 insecticide Maximum application of 11.3 oz/acre for growing season for grazing or hay harvest. *Minimum five (5) days between applications.*
Carbaryl Sevin (various formulations)	See product label	12 hr	7 d before harvest or grazing for alfalfa, clovers, birdsfoot trefoil 14 d for pasture	IRAC Group 1A insecticide *NOTE: Carbaryl has not given acceptable control in some parts of the state. Results on fall armyworm should be carefully noted because of the potential for resistance in this species. See your county agent for local control history.* Best to apply 24 – 48 hrs before expected rain because of potential product wash-off. See wash-off resistance information on label (if present.). Numerous formulations of Carbaryl are available. Consult label for use rates.
Chlorantraniliprole Prevathon	14-20 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Do not make more than 4 applications per year. Only one application per cutting. Do not apply more than 60 oz/A of Prevathon per year.
Chlorantroniliprole (Rynaxypyr) Coragen	3.5 – 5.0 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Protect surface waters with buffer zone-recommend 100 ft.; recommend not apply less than 48 hrs before expected rainfall. Apply at egg-hatch or when newly hatched larvae are present before damaging populations develop. Maximum application of 15.4 oz/acre per crop. Minimum seven (7) days between treatments. Maximum four (4) applications per acre per season.

ARMYWORMS [True Armyworms *(Pseudaletia unipuncta)***, Fall Armyworms** (*Spodoptera frugiperda*), Yellowstripped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others (cont)

Pesticide	Product/acre	REI	PHI	Comments
Diflubenzuron ***R*** Dimilin 2L	2.0 oz/ac	12 hrs	1 d hay harvest. 1 d grazing.	IRAC Group 15 insecticide Do not exceed 6 oz per acre per year. For maximum control apply to < ½ inch larvae. Use high spray volume – see label
Lambda-cyhalothrin ***R*** Karate, Silencer and Others	2.56 – 3.84 oz/ac	24 hrs	0 d grazing, 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.72 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Karate Z	1.28-1.92 oz / ac	24 hrs	0 d grazing, 7 d hay harvest	Do not apply more than 0.36 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Methomyl ***R*** Lannate LV Lannate SP *Water soluble powder in water soluble bags*	*Bermuda pasture:* 0.75 – 3.0 pts /ac *Bermuda pasture:* 0.25 – 1 lb /ac	48 hrs	*Bermuda pasture: Last appl. 7 d before feeding forage, grazing; 3 d cutting dry hay*	IRAC Group1A insecticide ***Lannate LV****: Bermuda pasture*: Do not apply more than 3 pts/ac per crop per year or 4 applications per crop. ***Lannate SP****: Bermuda pasture*: Do not apply more than 1lb per crop or make more than 4 applications per year.
Methoxyfenozide Intrepid	4.0-8.0 oz / ac	4 hrs	0 d grazing, 7 d hay harvest.	IRAC Group 18 insecticide No more than one (1) application per cutting. Do not apply more than 32 oz per year.
Spinosad Tracer Naturalyte	1-2 oz / ac	4 hrs	Allow spray to dry before grazing. 3 d hay harvest.	IRAC Group 5 insecticide Do not apply more than 6 oz per acre per season.
Zeta-cypermethrin ***R*** Mustang Max Mustang Max EC	2.8 – 4.0 oz / ac	12 hr	Grass forage & hay 0 d Grass straw & screenings 7 d	IRAC Group 3 insecticide *RUP: toxicity to fish & aquatic organisms.* See label for buffer zones, other info. Apply in sufficient water to ensure thorough coverage of foliage; increase water in hot dry, weather. *Minimum 7 days between applications for forage & hay, 17 days for straw, screenings, other. Do not spray livestock. Allow application to dry before letting livestock graze on treated area.* ***Maximum seasonal total/ac for grass forage, fodder, and hay group and grass grown for seed is*****:** *Hay* : 17.2 oz / ac / season; *Forage, straw & seed screenings*: 21.5 oz /ac/season.

GRASSHOPPERS and CHINCH BUGS

***General Comments*:** Nymphs easier to kill than adults. May need to apply to grass and field edges.

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin ***R*** Baythroid XL	2.6 – 2.8 oz/acre	12 hr	0 d grazing and hay harvest	IRAC Group 3 insecticide Maximum application of 11.3 oz/acre for growing season. *Minimum five (5) days between applications.*
Carbaryl Various formulations	See Product Label	12 hr	14 d	IRAC Group 1A insecticide Best to apply 24 – 48 hrs before expected rain because of potential product wash-off. See wash-off resistance information on label (if present.) Various formulations of Carbaryl are available. Consult label for proper use requirements.
Diflubenzuron ***R*** Dimilin 2L Dimilin 25W	1.0 – 2.0 oz/acre on early instars 1.0 – 2.0 oz/ac	12 hrs	1 d hay harvest. 1 d grazing.	IRAC Group 15 insecticide *Grasshoppers only.* Do not exceed 6 oz per acre per year. Use one application on early instar (2nd – 4th instar) nymphal stages. Use high rate for pastureland. Use high spray volume – see label. First application at early instar nymphs. Use high rate for pastures. See label for spray volume and addition of oil for hot/dry weather
Lambda-cyhalothrin ***R*** Karate, Silencer and others Karate Z	2.56 – 3.84 oz/acre 1.28-1.92 oz per acre	24 hrs	0 d grazing, 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.72 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments. Do not apply more than 0.36 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Lambda-cyhalothrin ***R*** + Chlorantraniliprole Besiege	5.0-9.0 oz/acre	24 hrs	0 d grazing 7 day harvest	IRAC Group 3 and 28 insecticide Do not exceed 27.0 oz/acre/year. Do not apply more than 9 oz/cutting. Apply a minimum of 10 GPA by ground. Wait a minimum of 7 days between applications.
Zeta-cypermethrin ***R*** Mustang Max Mustang Max EC	2.8 – 4.0 oz / ac	12 hr	Grass forage & hay 0 d Grass straw & screenings 7 d	IRAC Group 3 insecticide *RUP: toxicity to fish & aquatic organisms.* See label for buffer zones, other info. Apply in sufficient water to ensure thorough coverage of foliage; increase water in hot dry, weather. *Minimum 7 days between applications for forage & hay, 17 days for straw, screenings, other. Do not spray livestock. Allow application to dry before letting livestock graze on treated area.* ***Maximum seasonal total/ac for grass forage, fodder, and hay group and grass grown for seed is*:** *Hay:* 17.2 oz / ac / season; *Forage, straw & seed screenings*: 21.5 oz /ac/season.

R = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

WEED CONTROL IN GRAIN SORGHUM

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Clarity/Banvel 4 S (*dicamba*)	8.0	0.25 lb	4	---	24 hours
Comments: Apply CLARITY/BANVEL at least 15 days prior to planting grain sorghum.					
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22-32 oz	0.75-1.13 lb ae			
Comments: Apply in 10-20 gal of water 2 to 4 weeks prior to your anticipated planting date to control existing groundcover. Consult product label to determine if a non-ionic surfactant is needed.					
Gramoxone SL 2 E (*paraquat*)	2.0-4.0 pt	0.5-1.0 lb	22	---	12 hours
paraquat 3 S	1.5-2.0 pt				
Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Better control of chickweed, henbit, deadnettle and cutleaf evening primrose than GLYPHOSATE alone. Add NIS at 1 qt/100 gal of spray mix.					

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Conservation Tillage Grain Sorghum[1]

	Glyphosate[2]	Glyphosate + 2,4-D[2]	Glyphosate + Atrazine[2]	Glyphosate + Clarity[2]	Gramoxone[2]	Gramoxone + 2,4-D[2]	Gramoxone + Clarity[2]
barley, little	E	E	E	E	G	G	G
bluegrass, annual	F	F	E	F	G	G	G
buttercups	E	E	E	E	E	E	E
chickweed, common	F	G	E	GE	E	E	GE
clovers	PF	F	F	FG	G	G	GE
cudweed	E	E	E	E	FG	FG	FG
dandelion	P	E	GE	E	N	E	GE
dock, curly	PF	G	G	GE	F	FG	GE
eveningprimrose, cutleaf	PF	E	E	GE	F	E	GE
geranium, Carolina	FG	E	E	E	GE	E	GE
henbit/deadnettle	F	G	E	GE	G	GE	E
horseweed (marestail)	E	GE	E	E	F	GE	E
mustard, wild	FG	E	GE	G	FG	E	G
pansy, field	F	F	GE	F	G	G	G
peanut, volunteer	F	F	F	G	P	F	GE
pepperweed, Virginia	G	E	GE	GE	G	GE	G
radish, wild	FG	GE	GE	GE	G	GE	GE
ryegrass, Italian	G	F	GE	F	FG	FG	FG
sorrel, red	E	E	E	E	E	E	E
spurry, corn	GE	GE	GE	GE	FG	G	G
swinecress	FG	G	G	G	PF	FG	FG
vetch	F	E	E	E	G	GE	GE
wheat/rye cover crop	E	E	E	E	FG	F	F

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Herbicide rates for burndown are: Atrazine at 1.0 lb/A; ET at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; and Gramoxone at 3.0 pt/A.

Important Ground and Surface Water Considerations Regarding the Use of Atrazine and Simazine Containing Herbicide Products.

ATRAZINE and SIMAZINE users are strongly encouraged to follow label guidelines, discussed below, to share in the responsibility of preserving the future use of ATRAZINE and SIMAZINE. These restrictions apply to all formulations of ATRAZINE and SIMAZINE, and all pre-mix package products that contain ATRAZINE and SIMAZINE.

Application Rate Restrictions: For soils that are not defined as highly erodible, the maximum use rate for ATRAZINE is 2.0 lb ai (active ingredient) per acre and for SIMAZINE is 2.0 lb ai per acre per season. For soils classified as highly erodible (as defined by NRCS), If conservation tillage is practiced with at least 30 percent crop residue coverage at planting, the maximum use rate is 2.0 lb ai per acre for ATRAZINE and SIMAZINE. If crop residue coverage is less than 30 percent, then the maximum rate for ATRAZINE and SIMAZINE is 1.6 lb ai per acre. If ATRAZINE **was not** applied prior to grain sorghum emergence, then the total amount applied should not exceed 2.0 lb ai per acre. If ATRAZINE was applied to a field preemergence, then the total amount of ATRAZINE **should not** exceed 2.5 lb ai per acre per calendar year. The total amount of SIMAZINE **should not** exceed 2.0 lb ai per acre per calendar year.

Setbacks: Operations that involve mixing, loading, rinsing, or washing ATRAZINE or SIMAZINE within 50 feet of wells (including abandoned wells, drainage wells, or sink holes), rivers, intermittent streams, lakes, or reservoirs is prohibited. This restriction does not apply to operations within a properly designed impervious pads and diked mixing/loading areas. ATRAZINE or SIMAZINE must not be applied aerially or by ground equipment within 66 feet of points where field surface water enters perennial or intermittent streams and rivers or within 200 feet around natural or impounded lakes and reservoirs. If ATRAZINE or SIMAZINE is applied to highly erodible land, the 66 foot buffer or setback from runoff entry points must be planted to crop, seeded with grass, or other suitable crop.

If ATRAZINE or SIMAZINE is applied to tile-terraced fields containing standpipes, then users are advised to follow one the following restrictions: 1) do not apply ATRAZINE or SIMAZINE within 66 feet of standpipes; 2) After applying ATRAZINE or SIMAZINE to the entire field, immediately incorporate it to a depth of 2-3 inches; or 3) Apply ATRAZINE or SIMAZINE to the entire field under conservation tillage practices where high crop residue levels are present.

Examples of Herbicide Products that Contain Atrazine or Simazine

Trade Name	Active Ingredient(s)	Trade Name	Active Ingredient(s)
Aatrex	*atrazine*	Harness Xtra	*acetochlor + atrazine*
Bicep II Magnum	*atrazine + s-metolachlor*	Guardsman MAX	*dimethenamid-p + atrazine*
Bicep Lite II Magnum	*atrazine + s-metolachlor*	Keystone	*acetochlor + atrazine*
Bullet	*alachlor + atrazine*	Lariat	*alachlor + atrazine*
Cinch ATZ	*s-metolachlor + atrazine*	Lumax	*s-metolachlor + atrazine + mestrione*
Degree Xtra	*acetochlor + atrazine*	Marksman	*dicamba + atrazine*
Expert	*glyphosate + s-metolachlor + atrazine*	Princep	*simazine*
Fultime	*acetochlor + atrazine*	Steadfast ATZ	*nicosulfuron + rimsulfuron + atrazine*

Preemergence Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aatrex 4WDL (*atrazine*)	1.6-2.0 qt	1.6-2.0 lb	5	60 days	12 hours
Aatrex Nine-O 90WDG	1.8-2.2 lb				
Comments: ATRAZINE is a RESTRICTED USE PESTICIDE. Use to control most broadleaf weeds and a few grasses. Tank mix with a grass herbicide for broader spectrum control.					
Alachlor (Micro-Tech 4ME or Intrro)	2.0-2.75 qt	2.0-2.75 lb	15	None	12 hours
Comments: MICRO-TECH is a RESTRICTED USE PESTICIDE. Controls most annual grasses (*except Texas Panicum*) and some broadleaf weeds. ALACHLOR may be tank mixed with ATRAZINE. Use only on sorghum seed treated with a safener.					
Dimethenamid-p (Outlook 6 EC)	10-16 oz	0.47-0.75 lb	15	40 days	12 hours
Comments: Controls most annual grasses (*except Texas Panicum*) and some broadleaf weeds. DIMETHENAMID-P may be tank-mixed with ATRAZINE (GUARDSMAN MAX). Use only on sorghum seed treated with a safener.					
Metolachlor			15	90 days	24 hours
Dual 8E/II	1.5-2.0 pt	1.5-2.0 lb			
Dual 25G/II G Mag.	6.0-8.0 lb				
S-metolachlor					
Dual Mag.7.62 EC Dual II Mag. 7.64 EC Cinch 7.64 EC	1.0-1.67 pt	0.95-1.59 lb			
Comments: Controls most annual grasses and some broadleaf weeds. Fair to good control of yellow nutsedge. METOLACHLOR and S-METOLACHLOR may be tank mixed with ATRAZINE. Generic formulations of METOLACHLOR are also available. DUAL II and DUAL II MAGNUM contain a safener that helps minimize the possibility of injury from S-METOLACHLOR applications. Use only on sorghum seed treated with a safener.					
Bicep II Magnum 5.5 SC	1.3-2.1 qt			60 days	24 hours
(*s-metolachlor*		0.78-1.27 lb	15		
+		+			
atrazine)		1.0-1.63 lb	5		
Comments: BICEP II MAGNUM is a RESTRICTED USE PESTICIDE. *Application rate is based on soil type:* Sandy soils = 1.3-1.6 qt/A, Medium textured soils = 1.6-2.1 qt/A. Use only on sorghum seed treated with a safener.					

Preemergence Herbicides for Weed Management in Grain Sorghum (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Bullet 4 ME Lariat 4 EC	2.5-3.75 qt			70 days	12 hours
(*alachlor* + *atrazine*)		1.56-2.34 lb + 0.94-1.41 lb	15 5		
Comments: BULLET and LARIAT are RESTRICTED USE PESTICIDES. *Application rate is based on soil type and organic matter:* Sandy soils = 2.5-3.0 qt/A, medium textured soils = 3.0-3.75 qt/A. Use only on sorghum seed treated with a safener.					
Cinch ATZ 5.5 SC	2.6-3.2 pt			60 days	12 hours
(*s-metolachlor* + *atrazine*)		0.78-0.96 lb + 1.0-1.24 lb	15 5		
Comments: CINCH ATZ is a RESTRICTED USE PESTICIDE. *Application rate is based on soil type:* Sandy soils = 2.6 pt/A, medium textured soils = 3.2 pt/A. Use only on sorghum seed treated with a safener.					
FulTime NXT 4.04 SC (*acetochlor* + *atrazine*)	2.0-3.7 qt	1.35-2.50 lb 0.67-1.24 lb	15 5	60 days	12 hours
Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. Application rate is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.9 qt/A. For soils with 1.5% organic matter or more, the application rate range is 2.3-3.7 qt/A. Use only on sorghum seed treated with a safener. Do not apply FULTIME to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.					

Postemergence Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*) Aim 1.9EW	0.5-1.0 fl oz	0.008-0.025 lb	14	3 days	12 hours
Comments: Apply AIM up through the 6 leaf growth stage to control small pigweed and annual morningglory. Excellent on large velvetleaf. Temporary leaf burn may occur. Add NIS at 1 qt/100 gal of spray mix. May be tank mixed with ATRAZINE, BANVEL, or CLARITY. Do not tank mix with AIM with a COC as crop injury may occur. Do not apply more than a total of 1.0 oz/A per season. **Rainfast interval = 6 hours.**					

Postemergence Herbicides for Weed Management in Grain Sorghum (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aatrex 4WDL (*atrazine*)	2.0 qt	2.0 lb	5	None	12 hours
Comments: Apply ATRAZINE before weeds exceed 3 inches in height and before grain sorghum exceed 12 inches in height. Add COC at 1 qt/A or emulsifible oil at 1 gal/A. If ATRAZINE was not applied prior to grain sorghum emergence, apply a maximum of 2.0 lbs ai/A. If a postemergence treatment is required following an earlier preemergence application, total ATRAZINE applied cannot exceed 2.5 lbs ai/acre per calendar year. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**					
FulTime NXT 4.04 SC (*acetochlor* + *atrazine*)	2.0-3.7 qt	1.35-2.50 lb 0.67-1.24 lb	15 5	60 days	12 hours
Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. Apply FULTIME NXT before grain sorghum exceeds 11 inches in height (generally 5-6 lf stage). Application rate is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.9 qt/A. For soils with 1.5% organic matter or more, the application rate range is 2.3-3.7 qt/A. Use only on sorghum treated with a seed protectant. Do not apply FULTIME NXT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.					
Banvel 4S (*dicamba*) Clarity 4S	0.5-1.0 pt	0.25-0.5 lb	4	24 hours	24 hours
Comments: Apply BANVEL from emergence to 8 inches tall. Use drop nozzles to apply to row middles and prevent spraying into the crop whorl when sorghum is 8 to 15 inches tall. *Use caution to prevent drift and injury to nearby sensitive crops.* **Rainfast interval = not indicated on label (suggest 1 hour).**					
Basagran 4S (*bentazon*)	1.5-2.0 pt	0.75-1.0 lb	6	12 days	48 hours
Comments: Apply BASAGRAN to control most broadleaf weeds less than 4 inches tall. Do not apply more than 2 pt/A of BASAGRAN per season. Do not apply after heading or blooming stage in sorghum. **Rainfast interval = 4 hours.**					
Buctril 2EC (*bromoxynil*) Buctril 4EC	1.5 pt 0.75 pt	0.375 lb	6	45 days	24 hours
Comments: Apply BUCTRIL from the 3-leaf growth stage up to the preboot growth stage to control small broadleaf weeds. Less drift potential than BANVEL or 2,4-D. Use 10 or more gallons of water per acre. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**					

Postemergence Herbicides for Weed Management in Grain Sorghum (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Huskie 2.06EC (*pyrasulfotole* + *bromoxynil*)	13-16 fl oz	0.031-0.039 lb + 0.18-0.22 lb	27 + 6	7 days	24 hours

Comments: HUSKIE is a RESTRICTED USE PESTICIDE. Apply HUSKIE from 3-leaf growth stage up to 12 inches in height. Treat broadleaves when small and actively growing. Do not apply more than 16 fl oz/A per application. Do not apply more than 2 applications of HUSKIE with a season maximum of 32 fl oz/A. Wait a minimum of 11 days between HUSKIE applications. Do not use air induction or flood jet nozzles to apply HUSKIE. Unacceptable crop response may occur if HUSKIE is applied to acreage previously treated with any product containing mesotrione (i.e., LUMAX, LEXAR, CALLISTO). Do not apply HUSKIE in a tank mixture with LORSBAN. Add ammonium sulfate at 1 lb/A if applied under challenging environmental conditions.

Marksman 3.2S (*dicamba* + *atrazine*)	2.0 pt	0.28 lb + 0.53 lb	4 + 5	60 days	24 hours

Comments: MARKSMAN is a RESTRICTED USE PESTICIDE. Apply MARKSMAN overtop grain sorghum from the 2- to 5-leaf stage of growth. For best result, apply at the 2- to 3-leaf stage of growth. All applications must be made before grain sorghum reaches 12" in height. Applications during periods of rapid growth may result in temporary leaning of the plants or rolling of leaves. These effects are usually outgrown within 10 to 14 days. On coarse textured soils, heavy rain immediately after application may cause sorghum injury. Do not use COC or NIS as crop injury may result. **Rainfast interval = 4 hours.**

Peak 57WDG (*prosulfuron*)	0.75-1.0 oz	0.027-0.036 lb	2	30 days	12 hours

Comments: Apply PEAK to grain sorghum from 5- to 30-inches in height and prior to head emergence. For best results, time application to optimum weed size rather than crop height. Use drop nozzles is sorghum is over 20-inches. Add NIS at 1 qt per 100 gal or COC at 1 qt per acre. Do not make a foliar or soil application of any organophosphate insecticide within 15 days before or 10 days after an application of PEAK. **Rainfast interval = 4 hours.**

Zest 75WDG (*nicosulfuron*)	0.67-1.33 oz	0.031-0.062 lb	2	**	4 hours

Comments: USE ONLY ON GRAIN SORGHUM VARIETIES CONTAINING THE DUPONT INZEN HERBICIDE TOLERANT TRAIT! Apply ZEST broadcast from emergence up to 20 inches tall. Optimum application timing is from 4- to 20-inch tall grain sorghum for optimum crop tolerance. Do not apply to grain sorghum taller than 20 inches. Two applications of ZEST are permitted in a season in case of regrowth or a subsequent flush of new weeds. Allow a minimum of 7 days between applications. Do not apply more than 1.8 oz/A of ZEST per season. Add a non-ionic surfactant at 1 qt per 100 gal of spray solution or crop oil concentrate at 1 gal per 100 gal of spray solution. In addition, add a spray grade nitrogen solution to the spray solution at 2 lb/A of AMS or 2 qt/A of UAN. If tank mixing ZEST with 2,4-D LVE or DICAMBA, do not use crop oil concentrate. Do not tank mix ZEST with HUSKIE because of reduced grass control and potential crop injury. ZEST may be tank mixed with 2,4-D LVE, DICAMBA, ATRAZINE, STARANE ULTRA, and ALLY XP. **Grain may be harvested once the crop has reached the mature grain stage. **Rainfast interval = 4 hours.**

2,4-D 4S amine or low volatile ester	0.5-1.5 pt	0.25-0.5 lb	4	30 days	48 hours

Apply 2,4-D broadcast overtop grain sorghum that is 6 to 15 inches tall to control most broadleaf weeds. Use drop nozzles if sorghum is more than 8 inches in height. *Use caution to prevent drift and injury to nearby sensitive crops.* **Rainfast interval = not indicated on label (suggest 1 hour minimum).**

Postemergence Directed Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
2,4-D 4S amine or low volatile ester	0.75-1.5 pt	0.188-0.75 lb	4	30 days	48 hours
Comments: Apply 2,4-D as a postemergence directed spray from 8 inches tall up to 15 inches tall using drop nozzles to minimize contact with grain sorghum plant. If grain sorghum plants are growing rapidly, reduce 2,4-D rate to 0.5 pt to minimize crop injury potential. *Use caution to prevent drift and injury to nearby sensitive crops.* **Rainfast interval = not indicated on label (suggest 1 hour).**					
Aim 2EC (*carfentrazone*)	1.0 fl oz	0.008 lb	14	3 days	12 hours
Aim 1.9EW					
Comments: Apply AIM as a postemergence directed spray from V8 to V14 growth stage. Add NIS at 1 qt per 100 gals of spray mixture. Avoid directing the spray in the whorl of the plant. Tank mix partners include ATRAZINE, 2,4-D AMINE, BANVEL, CLARITY, or PEAK. **Rainfast interval = 6 hours.**					
Gramoxone SL 2E (*paraquat*)	1.0-2.0 pt	0.25-0.5 lb	22	48 days	12 hours
Comments: Apply GRAMOXONE as a postemergence directed spray when grain sorghum is at least 12 inches tall. A hooded or shielded sprayer is recommended to minimize spray contact with grain sorghum foliage. Apply in a minimum of 10 gallons of water per acre. Coverage is important for weed control performance. Weeds 6 inches or taller may not be controlled. Add NIS at a rate of 2 qt per 100 gals of spray mixture. If using drop nozzles, arrange nozzles to spray no higher than lower 3 inches of the stalks. Some foliage will be injured but crop will recover and develop normally. Do not exceed 2 postemergence directed applications or 4.0 pt/A per season of GRAMOXONE. **Rainfast interval = 30 minutes.**					
Linex 4L (*linuron*)	1.0-1.5 pt	0.25-0.75 lb	7	75 days	24 hours
Lorox 50DF	1.0-2.0 lb	0.5-1.0 lb			
Comments: Apply LINEX or LOROX as a postemergence directed spray when grain sorghum is at least 15 inches tall. For best results, apply when there is sufficient height differential between weeds and the crop so that the directed spray thoroughly covers all weed foliage without contact of upper leaves or whorl of the grain sorghum by spray or drift. Add NIS at a rate of 2 qt per 100 gals of spray mixture. Spray to cover weeds no more than 3 to 4 inches tall. Use lower rate when weeds are no taller than 2 inches and higher rate for weeds up to 4 inches tall. Non-pressure nitrogen solution may be substituted for all or part of the water carrier. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**					

Harvest Aids for Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.0 fl oz	0.016 lb	14	3 days	12 hours
Aim 1.9EW					
Comments: Apply AIM after crop is physiologically mature and grain has begun to dry down (black layer has formed). Desiccates annual morningglory and other harvest impediments. Add a COC at 1-2 gal/100 gals, NIS at 1 qt/100 gals, or MSO at 1-2 gal/100 gals to the spray mix. Apply AIM in a minimum of 10 gal/A spray volume. **Rainfast interval = 6 hours.**					
Glyphosate acid equivalent (ae)			9	7 days	12 hours
4.5 lb ae/gal	22-44 fl oz	0.75-1.5 lb ae			
Comments: Apply after sorghum is physiologically mature and has reached 30 percent grain moisture or less. Do not use glyphosate if grain sorghum is infected with charcoal rot as lodging may occur. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**					
Defol 750 7.5SL (*sodium chlorate*)	2.4-3.2 qt	4.5-6.0 lb	NC	7 to 10 days	12 hours
Defol 5 5.0SL	3.6-4.8 qt				
Comments: Apply DEFOL 7-10 days before anticipated harvest after physiological maturity to reduce the moisture of the grain while crop is standing. Use lower rate when grain moisture is low and weather is clear and dry. Use higher rate when conditions for dessication are poor. Apply DEFOL with a NIS at 2-4 pt per 100 gal of spray solution. Apply in a minimum of 10-20 GPA for ground (5-10 GPA for air) applications. Higher spray volumes will also provide better weed desiccation results. Do not mix DEFOL with other insecticides or other organic materials because a fire or explosion may result. **Rainfast interval = 24 hours.**					

Weed Response to Herbicides for Grain Sorghum Weed Management[1]

	POSTEMERGENCE														POST-DIRECTED				
	Atrazine	Alachlor[2]	Bicep II Magnum[2]	Bullet/Lariat[2]	Dimethenamid-p[2]	S-Metolachlor[2]	Atrazine	Aim	Banvel/Clarity	Basagran	Buctril	Marksman	Zest[3]	2,4-D	Aim	Banvel/Clarity	Linex/Lorox	Gramoxone	2,4-D
anoda, spurred	GE	---	GE	GE	---	---	GE	P	GE	P	---	GE	FG	G	P	GE	---	GE	G
barnyardgrass	GE	GE	E	E	E	G	GE	P	P	G	P	P	GE	P	P	P	E	G	P
beggarweed, Florida	E	---	E	E	P	F	G	F	G	P	G	FG	G	P	G	G	E	E	P
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	PF	P
citronmelon	G	P	G	G	P	P	G	FG	E	P	G	G	---	E	P	G	E	F	E
cocklebur, common	E	P	G	G	P	P	E	P	E	P	---	E	F	G	P	E	GE	GE	G
cowpea	E	P	E	E	P	P	E	FG	E	P	FG	E	---	E	---	E	G	G	E
crabgrass	F	E	E	E	E	E	G	P	P	P	P	P	GE	P	P	P	GE	GE	P
crotolaria, showy	GE	P	GE	GE	P	P	GE	F	G	P	G	G	---	G	G	G	E	G	G
croton, tropic	GE	P	G	G	P	P	G	G	GE	E	E	GE	---	E	G	E	E	GE	E
crowfootgrass	P	E	E	E	E	E	G	P	P	P	P	P	E	P	P	P	GE	GE	P
dayflower, Benghal	F	GE	GE	GE	GE	GE	GE	---	GE	P	---	---	---	GE	---	GE	GE	GE	GE
eclipta	GE	---	GE	GE	---	---	GE	FG	G	FG	G	G	---	G	FG	G	G	FG	G
goosegrass	P	E	E	E	E	E	G	P	P	P	P	P	E	P	P	P	G	GE	P
jimsonweed	E	PF	E	E	P	P	E	GE	E	E	E	E	FG	E	GE	E	E	GE	E
johnsongrass, seedling	P	P	GE	P	P	F	F	P	P	P	P	P	E	P	P	P	G	GE	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P	GE	P	P	P	P	P	P
lambsquarters, common	E	G	E	E	G	G	E	GE	E	FG	E	E	F	E	G	E	E	G	E
morningglory, annual	GE	P	G	G	P	P	G	G	E	P	G	E	F	E	G	E	E	G	E
nutsedge, purple	P	P	P	P	F	FG	P	P	P	P	P	F	F	P	P	P	P	FG	P
nutsedge, yellow	P	PF	F	PF	G	G	PF	P	P	G	P	F	F	P	P	P	F	FG	P
panicum, fall	PF	E	E	E	GE	E	G	P	P	P	P	P	G	P	P	P	GE	GE	P
panicum, Texas	P	P	P	PF	PF	PF	F	P	P	P	P	P	GE	P	P	P	G	GE	P
pigweed spp.	E	E	E	E	E	G	E	G	E	P	F	GE	GE	E	G	E	E	GE	E
poinsettia, wild	GE	P	GE	GE	P	P	GE	---	GE	P	PF	E	---	GE	---	GE	GE	G	GE
purslane, common	E	G	E	E	G	G	E	G	E	P	---	---	---	G	G	E	G	G	G
pusley, Florida	E	GE	E	E	GE	GE	G	FG	G	P	E	E	---	G	FG	E	G	GE	G
ragweed, common	E	PF	E	E	F	PF	GE	FG	E	G	E	E	F	E	P	E	E	G	E
sandbur, field	F	G	GE	G	G	G	F	P	P	P	P	P	E	P	P	P	E	FG	P
senna, coffee	F	P	F	F	P	P	FG	P	E	P	F	GE	FG	GE	P	E	GE	GE	GE
sesbania, hemp	FG	P	FG	FG	P	P	FG	F	E	P	G	GE	PF	G	F	E	G	PF	G
sicklepod	GE	P	G	G	P	P	G	P	GE	P	P	GE	PF	G	P	E	GE	G	G
sida, prickly	E	G	E	E	P	P	GE	FG	G	G	F	E	P	G	G	E	GE	FG	G
signalgrass, broadleaf	PF	GE	GE	GE	GE	GE	F	P	P	P	P	P	GE	P	P	P	GE	GE	P
smartweed, Pennsylvania	GE	P	E	GE	P	P	G	FG	E	E	GE	E	G	F	G	E	GE	GE	F
spurge	GE	---	GE	GE	---	---	GE	FG	G	F	GE	GE	---	G	F	E	G	FG	G
starbur, Bristly	GE	P	GE	GE	P	P	E	---	E	E	F	GE	---	GE	E	GE	GE	G	GE
velvetleaf	FG	PF	G	G	P	P	G	F	GE	GE	GE	E	F	G	E	G	G	P	G

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70% control; --- = Insufficient Data.

[2]Use only on sorghum hybrids treated with a safener.

[3]Use only on grain sorghum varieties containing the Inzen Herbicide Tolerance Trait

GRAIN SORGHUM INSECT CONTROL

Francis P. F. Reay-Jones, Extension Entomologist

A new pest of sorghum, the **sugarcane aphid** (*Melanaphis sacchari*) was found for the first time in South Carolina in October 2014. This invasive species was first detected in the continental United States in Florida in 1977 and in Louisiana in 1999 on sugarcane where it remains a minor pest.

The insect switched hosts in 2013 and was found on grain and forage sorghum in Texas. This new strain or biotype was also found in Mississippi in 2013, and it rapidly spread in 2014 to Arkansas, Tennessee, Alabama, Georgia, and South Carolina. It is currently unknown if the aphid can successfully overwinter in South Carolina. However, the insect was able to successfully infest sorghum fields in South Carolina in 2015 and 2016, in addition to spreading to many new states. The dark cornicles (tail pipes) and dark tarsi (feet) differentiate this species from the other main pest species of aphids in sorghum.

The sugarcane aphid can cause significant economic damage to sorghum. The insect feeds on plant sap and can seriously injure or kill plants. While feeding, aphids secrete a sticky substance called honeydew which can cover plants and cause problems with harvesting. Since 2015, infestations of sugarcane aphids have been severe enough in some fields in South Carolina to cause complete crop failure, though on average, yield losses were less across the state. Research trials at the Pee Dee and Edisto RECs are focusing on assessing the impact of this pest on sorghum in South Carolina and providing management recommendations.

Labeled products for control of aphids on sorghum include chlorpyrifos and dimethoate, but, often, these products only provide fair control, and pre-harvest intervals are lengthy (30 and 28 days, respectively, at the lowest rates). Data from trials in South Carolina indicate that dimethoate provide poor levels of control, and chlorpyrifos provided fair levels of control, though a high rate may be needed with heavy infestations. Pyrethroids will flare populations of aphids by reducing numbers of their natural enemies, so they should not be used when sugarcane aphids are present. The new insecticide Sivanto (flupyradifurone) is labeled on sorghum in South Carolina. Under FIFRA section 2(ee), a reduced rate (4-7 oz of product per acre) of Sivanto is available for control of sugarcane aphid on sorghum. This insecticide provided very good levels of control in our trials.

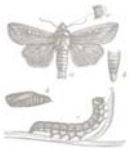
In 2015 and 2016, a section 18 Emergency Exemption was approved for Transform (sulfoxaflor) in South Carolina. While this product provides good control, the section 18 Emergency Exemption expires on 8 April 2017. As of writing (December 2016), Transform is not approved for use on grain sorghum for the 2017 growing season. The only recommended insecticides are therefore Sivanto (very good control) and chlorpyrifos (fair to good control).

Because sugarcane aphids can build up rapidly, fields should be scouted at least once a week, preferably twice a week. Until thresholds are developed with data from South Carolina, thresholds from the mid-South are to be considered, with 20% plants infested with localized areas of heavy honeydey and established aphid colonies until boot. After boot and until dough stage, a threshold of 30% plants infested is to be considered.

In addition to determining the pest status of the sugarcane aphid and exploring insecticide efficacy, research will also focus on developing sampling procedures and economic thresholds, as well as identifying practices that could minimize the need to use insecticides. Grain sorghum hybrids with tolerance to sugarcane aphids can play a major role in slowing the buildup of aphid populations and delaying the need to using insecticides. It is important to note that these tolerant hybrids do not provide 100% control and insecticide applications may still be needed.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Aphids (seed insecticide) 	Clothianidin PONCHO 600	5.1-6.4 fl oz /100 lb of seed	-	-	-	Seed treatment
	Imidacloprid GAUCHO 600	6.4fl oz/100 lb of seed	12	45	45	Seed treatment
	Thiomethoxam CRUISER 5FS	5.1-7.6 fl oz / 100 lb of seed	12	-	-	Seed treatment
Aphids (post-emergence insecticides) (all species except sugarcane aphid)	Dimethoate DIMETHOATE 4E DIMETHOATE 400	 0.5-1 pt/ac 0.5-1.5 pt/ac	 48 48	 28 28	 28 28	Use 25-40 gal of water per acre for ground application.
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	 0.5-1 pts/acre 0.5-1 pts/acre	 24 24	 30 30	 30 30	
Sugarcane Aphid	Flupyradifurone SIVANTO	4-7 oz/ac	4	7	21	Use at least 10 gallons/ac for ground applications.
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	 0.5-1 pts/acre 0.5-1 pts/acre	 24 24	 30 30	 30 30	High rate may be needed
Armyworms (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	 1.25-2.5 lb/ac 1-2 qts/ac	 12 12	 21 21	 14 14	

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworms (post-emergence insecticides) (*cont.*)	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	 1-2 pt/ac 1-2 pt/ac	 24 24	30 for 1 pt/ac 60 for 2 pt/ac	30 for 1 pt/ac 60 for 2 pt/ac	For ground application, use at least 15 gal/ac of water.
	Deltamethrin DELTA GOLD 1.5EC R	1.3-1.9 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Gamma-cyhalothrin PROAXIS R PROLEX R	2.56-3.84 oz/ac 1.02-1.54 oz/ac	24 24	30 30	30 30	
	Lambda-cyhalothrin KARATE Z R WARRIOR R	1.28-1.92 2.56-3.84 oz/ac	24 24	30 30	30 30	Use higher rates for large larvae.
	Methomyl LANNATE LV R LANNATE SP R	0.75-1.5 pts/ac 0.25-0.5 lbs/ac	48 48	14 14	14 14	Use at least 10 gal. of water per acre for ground application.
	Spinosad TRACER BLACKHAWK	1.5-3 oz/ac 1.7-3.3 oz/ac	4 4	7 7	14 14	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.
Chinch bug (seed insecticide) 	Clothianidin PONCHO 600	5.1-6.4 fl oz /100 lb of seed	-	-	-	Seed treatment
	Imidacloprid GAUCHO 600	6.4fl oz/100 lb of seed	12	45	45	Seed treatment
	Thiomethoxam CRUISER 5FS	5.1-7.6 fl oz / 100 lb of seed	12	-	-	Seed treatment
Chinch bug (at planting)	Chlorpyrifos LORSBAN 15G	8 oz/ 1000 ft of row	24	-	-	Apply in T-band. Suppression only.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Chinch bug (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	2-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb/ac 1-2 qts/ac	12 12	21 21	14 14	
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	1-2 pts/acre 1-2 pts/acre	24 24	30 for 1 pt/ac 60 for 2 pt/ac	30 for 1 pt/ac 60 for 2 pt/ac	Apply directed toward based of plant with enough water to cover 8 to 12 inch band in center of row. For plants less than 6 inches high, apply band centered over row.
	Deltamethrin DELTA GOLD 1.5EC R	1.3-1.9 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ac	12	21	21	Spray at base of plant for best results.
	Gamma-cyhalothrin PROAXIS R PROLEX R	3.84 oz/ac 1.54 oz/ac	24 24	30 30	30 30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
	Lambda-cyhalothrin KARATE Z R WARRIOR R	1.92 3.84 oz/ac	24 24	30 30	30 30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
Corn earworm (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb/ac 1-2 qts/ac	12 12	21 21	14 14	
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	2 pts/acre 2 pts/acre	24 24	60 60	60 60	For ground application, use at least 15 gal/ac of water.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ac	12	21	21	
	Gamma-cyhalothrin PROAXIS R PROLEX R	2.56-3.84 oz/ac 1.02-1.54 oz/ac	24 24	30 30	30 30	
	Lambda-cyhalothrin KARATE Z R WARRIOR R	1.28-1.92 2.56-3.84 oz/ac	24 24	30 30	30 30	Use higher rates for large larvae.
	Methomyl LANNATE LV R LANNATE SP R	0.75-1.5 pts/ac 0.25-0.5 lbs/ac	48 48	14 14	14 14	Use at least 10 gal. of water per acre for ground application.
	Spinosad TRACER BLACKHAWK	1.5-3 oz/ac 1.7-3.3 oz/ac	4 4	7 7	14 14	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.
Cutworm 	Chlorpyrifos LORSBAN 15G	8 oz/ 1000 ft of row	24	-	-	Apply in T-band.
	Beta-cyfluthrin BAYTHROID XL R	1-1.3 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	2.5 lb/ac 2 qts/ac	12 12	21 21	14 14	
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	1-2 pts/acre 1-2 pts/acre	24 24	30 for 1 pt/ac 60 for 2 pt/ac	30 for 1 pt/ac 60 for 2 pt/ac	Apply directed toward based of plant with enough water to cover 8 to 12 inch band in center of row. For plants less than 6 inches high, apply band centered over row.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
	Deltamethrin DELTA GOLD 1.5EC R	1-1.5 oz/ac	12	14	14	For ground application, use at least 5 gal/ac.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ac	12	21	21	Spray at base of plant for best results.
	Gamma-cyhalothrin PROAXIS R PROLEX R	1.92-2.56 oz/ac 0.77-1.02 oz/ac	24 24	30 30	30 30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
	Lambda-cyhalothrin KARATE Z R WARRIOR R	0.96-1.28 1.92-2.56 oz/ac	24 24	30 30	30 30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
	Zeta-cypermethrin MUSTANG MAX R	1.28-4.0 oz/ac	12	14	45	
Sorghum midge (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.0-1.3 oz/ac	12	14	14	
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	0.5 pts/acre 0.5 pts/acre	24 24	30 30	30 30	Apply when 30% to 50% of the seed heads are in bloom.
	Deltamethrin DELTA GOLD 1.5EC R	1.3-1.9 oz/ac	12	14	14	For ground application, use at least 5 gal/ac.
	Dimethoate DIMETHOATE 4E	0.25-0.5 pt/ac	48	28	28	Use 25-40 gal of water per acre for ground application.
	Esfenvalerate ASANA XL R	2.9-5.8 oz/ac	12	21	21	
	Gamma-cyhalothrin PROAXIS R PROLEX R	1.92-2.56 oz/ac 0.77-1.02 oz/ac	24 24	30 30	30 30	Apply when 25% of heads have emerged and are in tip bloom.
	Lambda-cyhalothrin KARATE Z R WARRIOR R	0.96-1.28 1.92-2.56 oz/ac	24 24	30 30	30 30	Apply when 25% of heads have emerged and are in tip bloom.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Sorghum midge (post-emergence insecticides) (*cont.*)	Methomyl LANNATE LV R LANNATE SP R	 0.75-1.5 pts/ac 0.25-0.5 lbs/ac	 48 48	 14 14	 14 14	Use at least 10 gal. of water per acre for ground application. Apply at 50% bloom.
Sorghum webworm (post-emergence insecticides)	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb/ac 1-2 qts/ac	12 12	21 21	14 14	
	Chlorpyrifos LORSBAN 4E R CHLORPYRIFOS 4E AG R	 2 pts/acre 2 pts/acre	 24 24	 60 60	 60 60	For ground application, use at least 15 gal/ac of water.
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz/ac	12	14	14	For ground application, use at least 5 gal/ac.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	30	30	
	Lambda-cyhalothrin KARATE Z R WARRIOR R	 1.28-1.92 oz/ac 2.56-3.84 oz/ac	 24 24	 30 30	 30 30	
	Methomyl LANNATE LV R LANNATE SP R	 1.5 pts/ac 0.5 lbs/ac	 48 48	 14 14	 14 14	Use at least 10 gal. of water per acre for ground application.
	Spinosad TRACER BLACKHAWK	1.5-3 oz/ac 1.7-3.3 oz/ac	4 4	7 7	14 14	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Stink bugs (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb/ac 1-2 qts/ac	12 12	21 21	14 14	
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.8 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Gamma-cyhalothrin PROAXIS R PROLEX R	2.56-3.84 oz/ac 1.02-1.54 oz/ac	24 24	30 30	30 30	
	Lambda-cyhalothrin KARATE Z R WARRIOR R	1.28-1.92 oz/ac 2.56-3.84 oz/ac	24 24	30 30	30 30	
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.
PRE-MIXED or CO-PACKAGED INSECTICIDES						
BRAND NAME	**RATE**	**REI**	**PHI**	**PGI**	**COMMENTS**	
COBALT (chlorpyrifos, gamma-cyhalothrin)	7-42 oz/ac	24	32	1 (green) 21 (fodder)		

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

WEED CONTROL IN PEANUT

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.0-2.0 oz	0.016-0.032 lb	14	3 days	12 hours
Aim 1.9EW					
Comments: Apply any time before planting. For best results, apply when weeds are less than 4 inches tall (less than 3 inch rosettes). Use higher rate for treating larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution), or MSO (1-2 gal per 100 gals of spray solution). Add 2,4-D to improve control of cutleaf eveningprimrose and wild radish. Tank mix partners include GLYPHOSATE or GRAMOXONE. **Rainfast interval = 6-8 hours.**					
ET 0.208EC (*pyraflufen ethyl*)	0.5-2.0 fl oz	0.0008-0.0032 lb	14	7 days	12 hours
Comments: Apply ET anytime before planting. Use a COC at 1-2% v/v (1-2 gal/100 gals). Provides control of small Palmer amaranth (less than 3 inches), annual morningglory, sicklepod, and other small broadleaf weeds. Apply in a minimum of 5 gallons spray solution per acre by air or 10 gallons spray solution per acre by ground. Do not apply more than 2.0 fl oz per acre per growing season.					
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22-32 oz	0.75-1.13 lb ae			
Comments: Apply any time prior to planting to control emerged weeds. Refer to specific label for weeds controlled, application rates, adjuvants, and precautions. GLYPHOSATE alone does not adequately control cutleaf evening primrose, wild radish, or Carolina geranium. GLYPHOSATE can also be tank-mixed with VALOR or AIM to improve the spectrum of control, particularly for annual morningglories. Refer to specific comments for VALOR. Applications to wheat and rye should be made before the boot stage or after the wheat is fully headed.					
Glyphosate acid equivalent (ae)			9	---	48 hours
4.5 lb ae/gal	22-32 oz	0.75-1.13 lb ae			
+	+	+			
2,4-D ester (various)	1.0-2.0 pt	0.48-0.96 lb	4		
Comments: Apply 15 to 30 days before planting to control emerged weeds. 2,4-D is the most cost-effective option available for burndown of cutleaf evening primrose. Consult 2,4-D product label for information regarding waiting intervals prior to planting following application of 2,4-D (Typically 15 [1.0 pt/A] to 30 [2.0 pt/A] days depending on 2,4-D rate).					

Preplant/Burndown Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Glyphosate acid equivalent (ae) 4.5 lb ae/gal + 2,4-D ester (various) + Leadoff 33.4SG (*rimsulfuron* + *thifensulfuron*)	22-32 oz 1.0-2.0 pt 1.5 oz	0.75-1.13 lb ae 0.5-1.0 lb 0.016 lb + 0.016 lb	9 4 2 2	---	12 hours

Comments: Apply LEADOFF after fall harvest through early spring 45 days or more before planting. Three way tank mixture of GLYPHOSATE + 2,4-D LVE + LEADOFF provides burndown and/or residual control of Carolina geranium, cutleaf eveningprimrose, marestail, vetches, wild radish, wild mustard, and chickweed. If GLYPHOSATE does not contain a built-in surfactant package, then add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal of spray solution plus an ammonium nitrogen liquid fertilizer (such as urea ammonium nitrate at 2 qt/A or ammonium sulfate at 2 lb/A).

Gramoxone SL 2E (*paraquat*) Paraquat 3.0S	2.5-3.75 pt 1.7-2.5 pt	0.625-0.94 lb	22	---	12 hours

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Apply any time prior to planting to control emerged weeds. Add NIS at 1 qt per 100 gals or COC at 1 gal per 100 gals of spray mixture. GRAMOXONE will not adequately control large horseweed, swinecress, purslane speedwell, curly dock, cutleaf eveningprimrose, and wild radish. Can also be tank-mixed with VALOR (1.0-3.0 oz/A) to improve the spectrum of control and provide residual weed control.

Valor SX 51WDG (*flumioxazin*)	1.0-3.0 oz	0.032-0.096 lb	14	60 days	12 hours

Comments: Apply up to 14 days prior to planting. Do not apply more than 3 oz/A of VALOR SX during a single growing season. No-till planters (strip-till) that incorporate the soil will result in reduced weed control in the furrow. Can be tank-mixed with other burndown herbicides to enhance speed of burndown (i.e., GLYPHOSATE or PARAQUAT).

Warrant 3ME (*acetochlor*)	1.25-2.0 qt	1.125-1.5 lb	15	90 days	12 hours

Comments: Apply anytime before planting. WARRANT provides residual control of small seeded broadleaves (including ALS-resistant Palmer amaranth) and grasses. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE, PARAQUAT, or 2,4-D LVE for imporved control of emerged weeds.

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Conservation Tillage Peanut[1]

	Aim/ET[2]	Glyphosate[2]	Glyphosate + 2,4-D[2]	Glyphosate + 2,4-D + Leadoff[2]	Glyphosate + Valor SX[2]	Gramoxone[2]	Gramoxone + Valor SX[2]
barley, little	F	E	E	E	E	G	G
bluegrass, annual	G	F	F	E	E	G	G
buttercups	G	E	E	E	E	E	E
chickweed, common	G	F	G	E	E	E	E
clovers	P	PF	F	G	F	G	GE
cudweed	G	E	E	E	E	FG	FG
dandelion	P	P	E	E	G	P	P
dock, curly	P	PF	G	F	G	F	P
eveningprimrose, cutleaf	GE	PF	E	E	FG	F	E
geranium, Carolina	GE	FG	E	E	E	GE	E
henbit/deadnettle	G	F	G	E	E	G	E
horseweed (marestail)	G	E	GE	GE	GE	F	GE
mustard, wild	G	FG	E	G	GE	FG	GE
pansy, field	G	F	F	---	F	G	G
pepperweed, Virginia	G	G	E	E	G	G	G
radish, wild	G	FG	GE	G	GE	G	GE
ryegrass, Italian	F	G	F	E	G	FG	FG
sorrel, red	F	E	E	G	E	E	E
spurry, corn	G	GE	GE	E	G	FG	G
swinecress	G	FG	G	E	FG	PF	PF
vetch	GE	F	E	E	FG	G	GE
wheat/rye cover crop	P	E	E	E	E	FG	G

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Herbicide rates: ET at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Leadoff at 1.5 oz/A; Gramoxone at 3.0 pt/A; and Valor SX at 3.0 oz/A.

Suggested Herbicide Programs for Peanut (w/o resistant pigweed)

Application Timing	*Conventional Tillage*		*Conservation Tillage*	
	Valor[1] (non-Cadre)	**Valor + Cadre**	**Valor[1] (non-Cadre)**	**Valor + Cadre**
Preplant Burndown	xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx	Glyphosate+2,4-D	Glyphosate+2,4-D
PPI	Prowl *or* Sonalan	Prowl *or* Sonalan	xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx
PRE	Valor + (Prowl, Dual, or Sonalan)	Valor + (Prowl, Dual, or Sonalan)	Valor + (Dual, Prowl, or Sonalan)	Valor + (Prowl, Dual or Sonalan)
Early POST (1st weed flush)	paraquat + Basagran/Storm + Dual or Warrant	paraquat + Basagran/Storm + Dual or Warrant	paraquat + Basagran/Storm) + Dual or Warrant	paraquat + Basagran/Storm + Dual or Warrant
POST	Paraquat + Basagran/Storm[2] + Dual or Warrant	Cadre[3] + Dual or Warrant	Paraquat + Basagran/Storm[2] + Warrant	Cadre[3] + Dual or Warrant
Late weed escapes[4]	2,4-DB	2,4-DB	2,4-DB	2,4-DB
	Ultra Blazer/Cobra	Ultra Blazer/Cobra	Ultra Blazer/Cobra	Ultra Blazer/Cobra
	Select/Poast/Fusilade			

[1]CADRE-FREE herbicide programs for growers who prefer not to use CADRE because of rotational cotton injury concerns.
[2]Apply PARAQUAT + BASAGRAN or PARAQUAT + STORM up to 28 days after peanut emergence.
[3]Apply CADRE up to 30-35 days after peanut emergence.
[4]Please note preharvest intervals for these treatments; consult respective herbicide labels for more details.

ALS-Resistant Palmer Amaranth Programs-Peanut[1]

Palmer amaranth populations exist in South Carolina that are resistant to several herbicide families including acetolactate synthase (ALS) inhibitors (i.e., Cadre and Strongarm), dinitroaniline (i.e., Prowl and Sonalan), and glyphosate (Roundup). The following table is designed to assist growers in developing an herbicide system to manage and/or prevent ALS-resistant Palmer amaranth populations in peanut.

Tillage	Preplant Burndown	Preemergence	1st Weed Flush	POST2 (by 28d after Planting)
Strip Tillage	Glyphosate or paraquat + 2,4-D	Valor[3]	paraquat + Storm[3] + Dual, Outlook, Warrant	2,4-DB + Cobra[3] *or* Ultra Blazer[3]
		Valor[3] + Dual Magnum, Outlook, Warrant	paraquat + Storm[3] + Dual, Outlook, Warrant	2,4-DB + Cobra[3] *or* Ultra Blazer[3]
Tillage	**Preplant Incorporated[4]**	**Preemergence**	**1st Weed Flush**	**POST (by 28d after Planting)**
Conventional Tillage	Prowl or Sonalan	Valor[3]	paraquat + Storm[3] + Dual, Outlook, Warrant	2,4-DB + Cobra[3] *or* Ultra Blazer[3]
	Prowl or Sonalan	Valor[3] + Dual Magnum, Outlook, Warrant	paraquat + Storm[3] + Dual, Outlook, Warrant	2,4-DB + Cobra[3] *or* Ultra Blazer[3]

[1]ALS-resistant (CADRE resistant) Palmer amaranth biotypes have been documented in South Carolina. A program multiple soil residual and postemergence herbicides with differing modes-of-action will be required for optimum control.
[2]CADRE and PURSUIT (ALS-inhibitors) may be tank mixed with COBRA or ULTRA BLAZER if control of other broadleaf weeds is needed. Because CADRE and PURSUIT are ALS-inhibitors, these tank mixtures are preferred over CADRE or PURSUIT alone.
[3]VALOR, STORM, COBRA, and ULTRA BLAZER have the same mode of action (PPO inhibitor). Do not make more than 2 applications of these herbicides per year.
[4]Use DUAL MAGNUM or OUTLOOK instead of SONALAN or PROWL if DNA-resistant Palmer amaranth biotypes are suspected and/or confirmed in your fields.

Weed Response to Soil Applied Herbicides for Peanut Weed Management[1]

	PPI[2]	PRE[3]/PPI						PRE[3]		
	Sonalan	Dimethamid-p	Dual Magnum	Intrro	Prowl	Pursuit	Strongarm	Solicam	Valor SX	Spartan Charge
anoda, spurred	P	P	P	P	P	G	FG	---	F	G
barnyardgrass	E	E	E	E	E	F	P	E	E	F
beggarweed, Florida	G	F	PF	PF	P	P	FG	G	GE	---
bermudagrass	P	P	P	P	P	P	P	P	P	P
citronmelon	P	P	P	P	P	P	G	G	G	F
cocklebur, common	P	P	P	P	P	GE	GE	PF	P	FG
cowpea	P	P	P	P	P	P	P	G	PF	P
crabgrass	E	E	E	E	E	F	P	GE	P	F
crotolaria, showy	P	P	P	P	P	P	---	---	G	---
croton, tropic	P	P	P	P	P	P	FG	G	G	---
crowfootgrass	E	E	G	E	E	P	P	G	P	F
dayflower, Benghal	P	GE	GE	GE	P	G	G	PF	F	---
eclipta	P	PF	PF	PF	P	P	GE	G	GE	---
goosegrass	E	E	E	E	E	F	P	G	P	F
jimsonweed	P	P	P	P	P	G	GE	FG	G	G
johnsongrass, seedling	E	F	F	F	E	G	P	---	P	F
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	GE	FG	F	F	GE	F	GE	FG	GE	E
morningglory, annual	P	P	P	P	P	G	FG	F	FG	E
nutsedge, purple	P	P	P	P	P	G	PF	P	P	G
nutsedge, yellow	P	F	FG	F	P	FG	PF	P	P	G
panicum, fall	E	G	G	G	E	PF	P	G	P	F
panicum, Texas	GE	P	P	P	GE	PF	PF	P	P	F
pigweed spp.	GE	GE	GE	GE	G	E	E	GE	E	GE
ALS-resistant	GE	GE	GE	GE	G	P	P	GE	E	GE
DNA-resistant	P	GE	GE	GE	P	E	E	GE	E	GE
poinsettia, wild	P	P	P	P	P	E	GE	P	---	---
purslane, common	GE	G	G	G	GE	G	---	GE	GE	F
pusley, Florida	E	G	G	G	E	G	GE	GE	GE	F
ragweed, common	P	F	P	PF	P	P	GE	G	GE	P
redweed (chocolateweed)	P	P	P	P	P	---	G	G	GE	---
ryegrass, annual	G	G	G	G	G	F	P	GE	GE	F
sandbur, field	E	FG	G	G	E	---	P	---	P	F
senna, coffee	P	P	P	PF	P	FG	P	F	PF	G
sesbania, hemp	P	P	P	P	P	P	PF	P	G	G
sicklepod	P	P	P	PF	P	P	P	F	P	P
sida, prickly	P	P	F	G	P	GE	FG	GE	GE	G
signalgrass, broadleaf	G	FG	FG	FG	G	P	P	G	P	F
smartweed, Pennsylvania	P	P	P	P	P	G	G	G	PF	E
spurge	P	PF	PF	PF	P	---	---	G	GE	G
starbur, bristly	P	P	P	F	P	F	E	PF	F	---
velvetleaf	P	P	P	P	P	PF	GE	---	F	GE

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = less than 70% control; --- = Insufficient Data.
[2]PPI, Preplant Incorporated.
[3]PRE, Preemergence.

Preplant Incorporated Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Intrro (*alachlor*)	3.0-4.0 qt	3.0-4.0 lb	15	70 days	12 hours
Comments: INTRRO is a RESTRICTED USE PESTICIDE. Incorporate to a depth of 1-2 inches deep in the soil zone. Excellent control of annual grasses and small seeded broadleaves. Performance on Palmer amaranth is slightly better than PROWL. Use a minimum of 3 qt/A for control of nutsedge on coarse textured soils. Do make more than two applications per year or exceed 4.0 qt/A per season. Do not feed forage or hay from treated crop.					
metolachlor (various)	1.0-1.33 pt	1.0-1.33 lb	15	90 days	24 hours
s-metolachlor (various)	1.0-1.33 pt	0.95-1.27 lb			
Comments: Controls some annual grasses (not Texas panicum) and small-seeded broadleaf weeds and may provide limited Florida beggarweed suppression. Controls or suppresses yellow nutsedge but not purple nutsedge. Incorporation with implements other than power tiller requires two passes, preferably at cross angles. Deep incorporation may reduce effectiveness. May be tank-mixed with PROWL or SONALAN for control of mixed infestations of annual grasses and yellow nutsedge. PPI treatments generally provide better control of nutsedge. Heavy rainfall after planting and/or non-uniform incorporation may result in crop injury expressed as delayed emergence and stunted growth of emerging plants. The generic formulations of metolachlor (PARALLEL PCS, STALWART, ME-TOO-LACHLOR) may not provide the same length of residual control as Dual Magnum.					
Outlook 6EC (*dimethenamid-p*)	12-21 fl oz	0.56-0.98 lb	15	---	12 hours
Comments: Controls some annual grasses (not Texas panicum) and small-seeded broadleaf weeds. Suppresses yellow nutsedge but not purple nutsedge. May be tank-mixed with PROWL or SONALAN for control of mixed infestations of annual grasses and yellow nutsedge. PPI treatments generally provide better control of yellow nutsedge.					
Prowl H_20 3.8 CS (*pendimethalin*)	1.8-2.4 pt	0.75-1.0 lb	3	21 days	24 hours
Prowl 3.3EC	2.0 pt	0.95 lb			
Comments: Controls annual grasses and small-seeded broadleaf weeds. Incorporate 1-2 inches deep within 7 days of application. Incorporation with implements other than power tiller requires two passes, preferably at cross angles. Use high rate for Texas panicum or where heavy weed populations are anticipated. May be tank-mixed with OUTLOOK, DUAL, WARRANT, or PURSUIT for control of mixed infestations of annual grasses and nutsedge. Prowl can be applied immediately after planting to a freshly prepared seedbed up to 2 days after planting but before crop emergence. However, adequate incorporation in the form of 0.75" of irrigation or rainfall is needed within 48 hours for optimum activation when applied by this method. In strip-tillage production systems, the rate of PROWL should be increased to 3.0 pts/A (3.3EC) or 2.6 pts/A (3.8CS).					

Preplant Incorporated Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Pursuit 70DG (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 oz				
Comments: Controls purple and yellow nutsedge, wild poinsettia, wild radish, pigweed, burgherkin, and several other annual species. Does not control Florida beggarweed or sicklepod. *Shallow* incorporation is preferred. May be tank-mixed with DUAL, PROWL, or SONALAN. Incorporated treatments are more persistent than preemergence or postemergence applications and are more likely to result in carryover.					
Sonalan HFP (*ethafluralin*)	2.0 pt	0.75 lb	3	---	24 hours
Comments: Controls annual grasses and small-seeded broadleaf weeds. Incorporate 2-3 inches deep within 2 days of application. Incorporation with implements other than power tiller requires two passes, preferably at cross angles. May be tank-mixed with OUTLOOK or DUAL for control of mixed infestations of annual grasses and nutsedge. SONALAN may also be applied as a surface application to freshly prepared seedbeds but must be incorporated by 0.5 inch of rainfall or irrigation within 2 days after application.					
Strongarm 84WDG (*diclosulam*)	0.45 oz	0.024 lb	2	30 days	12 hours
Comments: STRONGARM provides general broadleaf weed control. Incorporate into top 1-3 inches of final seedbed. Good to excellent control of many species including bristly starbur, wild poinsettia, eclipta, and copperleaf. Should be tank-mixed with a grass herbicide. Poor control of sicklepod. Control of nutsedge has been variable and inconsistent.					

Chemigation for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Metolachlor (various) or *s-metolachlor* (various) or Prowl H2O 3.8SC (*pendimethalin*) Prowl 3.3EC			15 15 3	90 days	24 hours
Comments: Use at normal recommended rates. May be applied by injection through center pivot irrigation systems. Apply after planting but before crop emergence. Requires proper system calibration and safety devices (check valves, cutoff switches, etc.) to provide effective weed control and prevent environmental contamination. Accurate herbicide application through chemigation may provide superior weed control compared to conventional ground applications. Generic formulations of metolachlor (PARALLEL PCS, STALWART, ME-TOO-LACHLOR) may not provide the same length of residual control as DUAL MAGNUM.					

Preemergence Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Intrro 4EC (*alachlor*)	3.0-4.0 qt	3.0-4.0 lb	15	70 days	12 hours

Comments: INTRRO is a RESTRICTED USE PESTICIDE. Excellent control of annual grasses and small seeded broadleaves. Performance on Palmer amaranth slightly better than preemergence applications of PROWL. Consult label for tank mix partners. Do make more than two applications per year or exceed 4.0 qt/A per season. Do not feed forage or hay from treated crop.

Metolachlor (various)	1.0-1.33 pt	1.0-1.33 lb	15	90 days	24 hours
s-metolachlor (various)	1.0-1.33 pt	0.95-1.27 lb			

Comments: If DUAL was used as a PPI treatment, any additional applications of DUAL should be delayed until peanuts begin emerging (at cracking). Multiple applications of preplant incorporated followed by at-cracking treatments generally improve control of sicklepod, Florida beggarweed, and yellow nutsedge. Controls some annual grasses (not Texas panicum) and small-seeded broadleaf weeds and may provide limited Florida beggarweed suppression. Controls or suppresses yellow nutsedge but not purple nutsedge. May be tank-mixed with PROWL/PENDIMAX or SONALAN for control of mixed infestations of annual grasses and yellow nutsedge. PPI treatments generally provide better control of nutsedge. The generic formulations of metolachlor (PARALLEL PCS, STALWART, ME-TOO-LACHLOR) may not provide the same length of residual control as s-metolachlor (DUAL MAGNUM). Do not apply more than 4 pt/A/year of DUAL 8E or 2.8 pt/A/year of DUAL MAGNUM.

Outlook 6EC (*dimethenamid-p*)	12-21 fl oz	0.56-0.98 lb	15	---	12 hours

Comments: OUTLOOK controls some annual grasses (not Texas panicum) and small-seeded broadleaf weeds. Provides some suppression of sicklepod and Florida beggarweed. Apply after planting and before crop and weeds emerge. May be used in a split application method. Preemergence treatments generally provide better broadleaf weed control/suppression. Do not exceed 21 oz/A/year of Outlook/Propel 6E.

Pursuit 70DG (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 oz				

Comments: PURSUIT controls purple and yellow nutsedge, wild poinsettia, wild radish, pigweed, burgherkin, and several other annual species. Does not control Florida beggarweed or sicklepod. May be tank- mixed with DUAL, PROWL/PENDIMAX, or SONALAN. Rainfall is needed for proper activation of PURSUIT with a surface application.

Sonalan HFP (*ethafluralin*)	2.0 pt	0.75 lb	3	---	24 hours

Comments: SONALAN may be applied as a surface application to freshly prepared seedbeds, but must be incorporated by 0.5-1.0" of rainfall or irrigation within 2 days after application. Controls annual grasses and small-seeded broadleaf weeds. May be tank-mixed with OUTLOOK or DUAL for control of mixed infestations of annual grasses and nutsedge.

Preemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Strongarm 84WDG (*diclosulam*)	0.45 oz	0.024 lb	2	30 days	12 hours

Comments: Apply STRONGARM after planting up through the cracking stage. STRONGARM provides good to excellent control of many species including bristly starbur, wild poinsettia, eclipta, and annual morningglories. Preemergence applications are not effective until rainfall or irrigation of at least 0.25 to 0.5 inches has moved STRONGARM to the zone where weed germination occurs. Should be tank-mixed with a grass herbicide. Poor control of sicklepod. Nutsedge control can vary depending on weed density or environmental conditions (especially soil moisture).

Spartan Charge 3.5SL (*sulfentrazone* + *carfentrazone*)	3.0-5.0 fl oz	0.074-0.123 lb + 0.008-0.014 lb	14 + 14	None	12 hours

Comments: Apply SPARTAN CHARGE prior to planting or up to 3 days after planting. SPARTAN CHARGE will provide postemergence activity on weeds (less than 3 inches in height) present at the time of application. Sprayer calibration and good agitation are essential with application of SPRATAN CHARGE. Avoid excessive overlap of spray swaths. Excellent control of morningglory, Palmer amaranth, lambsquarters, and yellow/purple nutsedge. Do not apply SPARTAN CHARGE after crop emergence, at cracking, or if seedling is close to the soil surface as undesirable crop response may occur. Tank mix with DUAL MAGNUM, PROWL, SONALAN, or OUTLOOK for improved grass control. Do not apply more than 7.0 fl oz/A of SPARTAN CHARGE per 12-month period. Do not apply SPARTAN CHARGE to soils classified as sands with less than 1.0% organic matter. Do not irrigate peanuts after a SPARTAN CHARGE application with water pH higher than 9. Do not irrigate peanuts during cracking. Do not feed treated peanut forage or peanut hay to livestock.

Valor SX 51WDG (*flumioxazin*)	3.0 oz	0.096 lb	14	60 days	12 hours

Comments: Apply VALOR immediately after planting but no later than 2 days after planting. Significant injury can occur if VALOR is incorporated or applied 3 or more days after planting. Plant peanuts at least 1.5" deep. DO NOT irrigate when peanuts are cracking. Rainfall or irrigation at cracking will cause temporary crop injury that should not result in reduced yields if applied according to the label. VALOR will provide good to excellent control of many broadleaf weeds including Florida beggarweed, *ALS-Resistant Palmer amaranth*, and tropic croton. VALOR will not control annual/perennial grasses, sicklepod, nutsedge, and cocklebur. VALOR can be tank-mixed with PROWL, SONALAN, DUAL MAGNUM, or OUTLOOK. Can also be used in strip-tillage peanut production systems in combination with glyphosate or paraquat to improve burndown control plus residual. Be sure to completely clean spray equipment THE SAME DAY OF USE as directed on the herbicide label. Do not let VALOR sit in the tank overnight.

Warrant 3ME (*acetochlor*)	1.25-2.0 qt	1.125-1.5 lb	15	90 days	12 hours

Comments: WARRANT provides residual control of small seeded broadleaves (including ALS-resistant Palmer amaranth) and grasses. Apply after planting but before weeds germinate. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control weeds that have germinated since planting. Environmental conditions that follow application of WARRANT including cold, wet soils or water logged conditions from excessive rain may result in crop injury. WARRANT applied preemergence to peanut may be tank mixed with PROWL, SONALAN, STRONGARM, TREFLAN, or VALOR.

Weed Response to Postemergence Herbicides for Peanut Weed Management[1]

	Paraquat	Paraquat + Storm	Paraquat + Basagran	Basagran	Cadre	Classic	Cobra	Fusilade DX	Poast/Poast Plus	Pursuit	Select/MAX	Storm	Ultra Blazer	2,4-DB
anoda, spurred	P	G	FG	G	G	F	F	P	P	F	P	F	P	P
barnyardgrass	G	G	G	P	G	P	G	GE	GE	G	GE	G	G	P
beggarweed, Florida	GE	GE	GE	P	FG	FG	PF	P	P	P	P	P	P	P
bermudagrass	P	P	P	P	P	P	P	G	FG	P	G	P	P	P
citromelon	F	G	F	P	G	P	G	P	P	P	P	F	F	G
cocklebur, common	G	GE	G	E	E	E	GE	P	P	E	P	GE	G	GE
cowpea	FG	F	F	P	PF	F	PF	P	P	P	P	PF	PF	PF
crabgrass	FG	FG	FG	P	G	P	P	G	GE	PF	GE	P	P	P
crotalaria, showy	F	FG	F	P	F	---	E	P	P	F	P	GE	E	F
croton, tropic	P	G	P	P	P	P	G	P	P	P	P	GE	G	P
crowfootgrass	G	G	G	P	G	P	P	FG	FG	P	G	P	P	P
dayflower, Benghal	G	G	G	G	FG	F	---	P	P	FG	P	F	P	P
eclipta	PF	FG	F	G	PF	P	FG	P	P	P	P	G	FG	P
goosegrass	FG	FG	FG	P	F	P	P	G	G	P	G	P	P	P
jimsonweed	P	F	E	E	E	GE	GE	P	P	FG	P	E	E	G
johnsongrass, seedling	G	G	G	P	FG	P	P	GE	GE	GE	GE	P	P	P
johnsongrass, rhizome	P	P	P	P	FG	P	P	GE	FG	G	G	P	P	P
lambsquarters, common	F	FG	F	F	PF	P	P	P	P	P	P	G	G	F
morningglory, annual	P	F	FG	F	G	G	G	P	P	G	P	G	GE	G
nutsedge, purple	PF	F	F	P	GE	PF	P	P	P	G	P	P	P	P
nutsedge, yellow	PF	FG	FG	G	GE	G	P	P	P	FG	P	F	P	P
panicum, fall	G	G	G	P	G	P	P	GE	GE	F	E	P	F	P
panicum, Texas	GE	GE	GE	P	FG	P	P	G	GE	PF	GE	P	P	P
pigweed spp.	F	GE	FG	P	E	F	E	P	P	E	P	GE	E	F
ALS-resistant	F	GE	FG	P	P	P	E	P	P	P	P	GE	E	F
poinsettia, wild	F	G	GE	P	E	P	GE	P	P	PF	P	G	GE	P
purslane, common	G	G	G	G	PF	P	E	P	P	PF	P	GE	G	G
pusley, Florida	P	P	P	P	P	F	G	P	P	P	P	E	E	P
ragweed, common	PF	G	F	F	F	G	E	P	P	P	P	GE	E	F
sandbur, field	F	FG	FG	P	G	P	PF	G	G	---	G	P	P	P
senna, coffee	F	E	E	G	G	P	FG	P	P	F	P	G	E	F
sesbania, hemp	F	G	FG	P	P	E	G	P	P	P	P	E	E	P
sicklepod	GE	GE	G	P	GE	G	P	P	P	P	P	P	P	F
sida, prickly	F	G	G	G	G	P	G	P	P	PF	P	G	P	P
signalgrass, broadleaf	G	G	G	P	G	P	PF	G	GE	G	GE	P	P	P
smartweed, Pennsylvania	GE	G	G	GE	FG	P	GE	P	P	GE	P	GE	GE	P
starbur, bristly	PF	FG	F	G	F	G	GE	P	P	PF	P	G	G	PF
velvetleaf	F	FG	G	G	G	GE	G	P	P	PF	P	FG	PF	P

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70% control; --- = Insufficient Data.

Early Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Intrro 4EC (*alachlor*)	3.0-4.0 qt	3.0-4.0 lb	15	70 days	12 hours

Comments: INTRRO is a RESTRICTED USE PESTICIDE. Excellent control of annual grasses and small seeded broadleaves. Performance on Palmer amaranth slightly better than PROWL. Consult label for tank mix partners. Do make more than two applications per year or exceed 4.0 qt/A per season. Do not feed forage or hay from treated crop.

Pursuit 70DF (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 fl oz				

Comments: PURSUIT provides effective control of nutsedge, wild poinsettia, wild radish, bristly starbur, prickly sida, and several other annual species. Weed size is especially critical for effective control of nutsedge, bristly starbur, and prickly sida. If weeds are emerged, NIS or COC should be included. May be tank-mixed with GRAMOXONE or 2,4-DB for broader spectrum control of emerged weeds. Do not graze or feed treated peanut forage, vines, hay, or straw to livestock.

Gramoxone SL 2S (*paraquat*)	8.0-16.0 fl oz	0.125-0.25 lb	22	None	12 hours
Paraquat 3.0 S	5.4-10.8 fl oz	0.127-0.25 lb			

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Provides effective contact control of sicklepod, morningglory, Florida beggarweed, Texas panicum, and many other problem weeds. When used alone, paraquat is not effective on smallflower morningglory, prickly sida, wild radish, or tropic croton. Apply anytime up to 28 days after ground crack. GRAMOXONE may be tank mixed with DUAL MAGNUM, PURSUIT, BASAGRAN, 2,4-DB, or STORM. Include NIS at 1 qt per 100 gal spray solution with all paraquat treatments (except DUAL MAGNUM tank mixes). Do not make more than 2 applications per season. Do not apply a total of more than 10.8 oz/A per year (PARAZONE/FIRESTORM) or 16.0 oz/A per year (GRAMOXONE SL). Peanut foliage injury is usually temporary. Conditions of high humidity, wet foliage, and/or wet soils can result in greater foliage burn. Thrips injury retards crop recovery. The success of early postemergence sprays can be greatly improved by 1) applying in a minimum spray volume of 15 GPA; 2) using spray nozzles that produce small droplets; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). **Rainfast interval is 30 minutes.**

Gramoxone SL 2E (*paraquat*)	8.0-16.0 fl oz	0.125-0.25 lb	22	None	12 hours
Paraquat 3S	5.4-10.8 fl oz	0.127-0.25 lb			
+	+	+			
Basagran 4.0 S (*bentazon*)	1.0 pt	0.5 lb	6	50 days	48 hours

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Provides effective, broad-spectrum early season weed control. Provides some suppression of yellow nutsedge. Generally, reduces peanut injury compared to other paraquat treatments. The lower rate of BASAGRAN (0.5 pt/A) is usually sufficient to reduce peanut foliar burn and provide control of smallflower morningglory. The higher rate of BASAGRAN (1.0 pt/A) is necessary for control of weeds such as bristly starbur and prickly sida. Apply anytime up to 28 days after ground crack. Include NIS at 1 qt per 100 gal spray solution with all paraquat treatments. The success of early postemergence sprays can be greatly improved by 1) applying herbicides in a minimum spray volume of 15 GPA; 2) using spray nozzles that produce small droplets; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). DUAL MAGNUM (or generic metolachlors) or WARRANT can be used in combination with this treatment to provide residual control of pigweed. A NIS is **not** recommended if DUAL MAGNUM or generic metolachlors are tank mixed with GRAMOXONE + BASAGRAN. **Rainfast interval is 4 hours.**

Early Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL 2S (*paraquat*)	8.0-16.0 fl oz	0.125-0.25 lb	22	None	12 hours
Paraquat 3S + Storm (*bentazon* + *acifluorfen*)	5.4-10.8 fl oz + 1.0-1.5 pt	+ 0.33-0.5 lb + 0.17-0.25 lb	6 14	75 days	48 hours

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Provides effective, broad-spectrum early season weed control. Provides some suppression of yellow nutsedge. Addition of DUAL MAGNUM or OUTLOOK improves contact activity and provides residual weed suppression/control, but could result in increased foliar peanut burn. Apply anytime up to 28 days after ground crack. Include NIS at 1 qt/100 gal spray solution with all PARAQUAT treatments (Except for DUAL MAGNUM tank mixes). The success of early postemergence sprays can be greatly improved by 1) applying herbicides in a minimum spray volume of 15 GPA; 2) using flat fan nozzles; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). DUAL MAGNUM (or generic METOLACHLORS) or WARRANT can be used in combination with this treatment to provide residual control of pigweed. A NIS is not recommended if DUAL MAGNUM or generic METOLACHLORS are used with GRAMOXONE + STORM. **Rainfast interval is 4 hours.**

Gramoxone SL 2S (*paraquat*)	8.0-16.0 fl oz	0.125-0.25 lb	22	None	12 hours
Paraquat 3S + Pursuit 70DF (*imazethapyr*)	5.4-10.8 fl oz + 1.44 oz	+ 0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 fl oz				

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Provides effective, broad-spectrum early season weed control. Provides some suppression of yellow nutsedge. Apply anytime up to 28 days after ground crack. Include NIS at 1 qt/100 gal spray solution with all PARAQUAT treatments. The success of "at-crack" sprays can be greatly improved by 1) applying herbicides in a minimum spray volume of 15 GPA; 2) using spray nozzles that produce small droplets; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). DUAL MAGNUM (or generic METOLACHLORS) or WARRANT can be used in combination with this treatment to provide residual control of pigweed. A NIS is not recommended if DUAL MAGNUM are used with GRAMOXONE + PURSUIT. **Rainfast interval is 4 hours.**

metolachlor (Stalwart, Parallel PCS, Me-Too Lachlor)	1.0-1.33 pt	1.0-1.33 lb	15	90 days	24 hours
S-metolachlor (Dual Magnum 7.62EC)	1.0-1.33 pt	0.95-1.27 lb			

Comments: Compared to PPI and PRE treatments, at-crack early postemergence applications provide better control of non-emerged broadleaf weeds, such as, Palmer amaranth, crabgrass, and Florida pusley. Apply DUAL MAGNUM at 1.33 to 2.0 pt/a for improved suppression of Florida beggarweed. May be tank-mixed with PARAQUAT treatments for improved contact activity and for suppression/control of problem broadleaf weeds and nutsedge. May also be tank-mixed with BASAGRAN, BASAGRAN + 2,4-DB, or STORM. DO NOT USE DUAL II MAGNUM OR CINCH FORMULATIONS AFTER PEANUT EMERGENCE. Do apply more than 2.67 pts/A/season of PARALLEL PCS, STALWART, ME-TOO-LACHLOR or 2.67 pts/A/season of DUAL MAGNUM. The generic formulations of metolachlor (PARALLEL, PARALLEL PCS, STALWART, ME-TOO-LACHLOR) have not provided the same length of residual control of certain weeds as similar rates of DUAL MAGNUM. Do not graze or feed peanut forage or fodder to livestock for 30 days following application.

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Basagran 4S (*bentazon*)	1.5-2.0 pt	0.75-1.0 lb	6	12 days	48 hours

Comments: Apply BASAGRAN from cracking through pegging for postemergence control of yellow nutsedge, cocklebur, bristly starbur, smallflower morningglory, prickly sida, and certain other weeds. Treat when broadleaf weeds are small and actively growing. Adjust rate according to weed size as noted on label. Two applications may be required for control of yellow nutsedge. For yellow nutsedge, include crop oil concentrate at 1 qt/A. Do not foliarly apply sulfur 14 days before or after use of COC to minimize risk of peanut foliage burn. Tank mix BASAGRAN with 2,4-DB at 0.5 pt/A for improved control of morningglories. Early-season applications of BASAGRAN at high rates following in-furrow applications of DI-SYSTON may infrequently result in SEVERE peanut injury. Do not graze treated peanut fields for at least 50 day after last BASAGRAN application. **Rainfast interval is 4 hours.**

Cadre 70DF (*imazapic*)	1.44 oz	0.063 lb	2	90 days	12 hours
Cadre/Impose 2S	4.0 fl oz				

Comments: CADRE provides excellent control of many broadleaf and grass weeds and both purple and yellow nutsedge. Add a NIS (1 qt per 100 gal of spray solution) or COC (1 qt/A) to the spray mixture. Apply as an early postemergence treatment when weeds are less than 2-3 inches in height. Under conditions of heavy weed pressure, applications of Cadre 10-14 days following an at-cracking treatment (GRAMOXONE combination) has resulted in superior weed control. Tank mixing GRAMOXONE with CADRE may result in increased peanut injury. Use of BASAGRAN in combination with CADRE may result in reduced weed control. Do not tank-mix with postemergence grass herbicides. **Rainfast interval is 3 hours.**

Classic 25DF (*chlorimuron*)	0.5 oz	0.008 lb	2	45 days	12 hours

Comments: Apply CLASSIC once per season as an over-the-top treatment 60 days after planting for mid-season Florida beggarweed and bristly starbur control or suppression. Under favorable conditions--good soil moisture, moderate temperatures, and high relative humidity--other species such as cocklebur, ragweed, and sicklepod may be suppressed. Avoid applications during periods of drought/heat stress because of potential for poor weed control and crop injury. Applications of CLASSIC may not provide acceptable control of Florida beggarweed that has escaped control or is regrowing after a previous application of CADRE. Include nonionic surfactant at 1 qt/100 gals spray solution with all CLASSIC applications. Addition of ammonium sulfate (2 lb/A) or feed grade urea (2 gal/A) improves activity on bristly starbur. APPLICATIONS OF CLASSIC APPLIED FROM 60 DAYS AFTER CROP EMERGENCE TO 45 DAYS BEFORE HARVEST MAY CAUSE AN INCREASE IN TSWV SYMPTOMS. Temporary yellowing of peanut foliage and reduction of canopy growth may occur. Can be tank-mixed with BRAVO or 2,4-DB. However, combinations of CLASSIC + 2,4-DB result in significantly more foliar crop injury compared to CLASSIC alone. Do not use CLASSIC on Spanish or Georgia-06G peanut varieties. Do not use CLASSIC with the combination of Classic + 2,4-DB on Southern Runner. Do not tank-mix CLASSIC with elemental sulfur. Do not graze treated field or harvest for forage or hay. **Rainfast interval is 1 hour.**

Cobra 2EC (*lactofen*)	12.5 oz	0.20 lb	14	45 days	12 hours

Comments: Apply COBRA after peanuts reach 6 true leaf stage of growth. Use a COC at 1% v/v (1 gal/100 gals). Provides good control of small, actively growing pigweeds, morningglories, ragweed, copperleaf, wild poinsettia, and eclipta. COBRA can be tank-mixed with BASAGRAN, CADRE, PURSUIT, SELECT, and 2,4-DB. Do not exceed 25 fl oz/A of COBRA per season. Do not make sequential applications of COBRA within 14 days of the first application. Do use treated peanut vines for feed or forage. **Rainfast interval is 30 minutes.**

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Fusilade DX (*fluazifop-p-butyl*)	8.0-24.0 fl oz	0.125 - 0.375 lb	1	40 days	12 hours
Comments: For the control of annual and perennial grass weeds. Use rate depends upon weed and weed size. Consult label for more details. Do not apply more than 48 oz/A/season. Do not apply more than 24 oz/A/application. Maintain a minimum of 14 days between applications. Use a NIS at 1 qt or COC at 1 gal per 100 gal of spray solution. FUSILADE DX also has some activity on bristly starbur. Do not feed treated green immature growing plants to livestock or harvest for livestock feed. **Rainfast interval is 1 hour.**					
Poast 1.5E (*sethoxydim*)	1.0-1.5 pt	0.19-0.28 lb	1	40 days	12 hours
Poast Plus 1.0EC	1.5-2.25 pt				
Comments: For control of annual and perennial grasses. Apply when annual grasses are small (1-6 inches) and actively growing. Under favorable conditions, large Texas panicum can be controlled. For perennial grass control, two applications are usually required for satisfactory control. Always apply with 1 qt/A COC. Tank-mixtures with other herbicides, such as 2,4-DB, STORM, BLAZER, or BASAGRAN may reduce grass control. Do not apply foliar sulfur 14 days before or after application to minimize risk of peanut foliage burn. Reduced spray volumes (10 GPA) may improve grass control. **Rainfast interval is 1 hour.**					
Pursuit 70 DF (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2 AS	4.0 fl oz	0.063 lb			
Comments: Generally, PURSUIT should be used early postemergence when weeds are extremely small. Controls wild radish, pigweeds, morningglories, cocklebur, and several other annual species. Compared to PPI, PRE, and At Crack/Early POST treatments, PURSUIT POST applications are less effective on nutsedge, wild poinsettia, and several other species. Applications should be made before nutsedge exceeds 3 to 4 inches and bristly starbur exceeds 2 inches. May be tank-mixed with GRAMOXONE or 2,4-DB. Postemergence control of escaped wild poinsettia is greatly enhanced in combination with GRAMOXONE. **Rainfast interval is 1 hour.**					
Select 2EC (*clethodim*)	6.0-16.0 fl oz	0.094-0.25 lb	1	40 days	24 hours
Select MAX 0.97EC	12.0-16.0 fl oz				
Comments: For control of annual and perennial grasses. Apply SELECT/SELECT MAX when grasses are small (<6 inches) and actively growing. Under favorable conditions, large Texas panicum and bermudagrass can be effectively controlled. Heavy bermudagrass pressure or larger Texas panicum will require a follow-up treatment. When tank-mixing with a broadleaf herbicide or controlling perennial grasses, increase rates (8-16 ozs/A-SELECT; 16-32 oz/A-SELECT MAX). Do not apply more than 32 oz/A/year (SELECT) or 64 oz/A/year (SELECT MAX). Always apply with a COC at 1% v/v (SELECT/ARROW). A NIS (0.25% v/v) can be used with SELECT MAX to reduce crop injury potential. May be tank-mixed with BASAGRAN, BLAZER, STORM, ORTHENE, DANITOL, or FOLICUR. Do not tank-mix with chlorothalonil products or reduced grass control can occur. **Rainfast interval is 1 hour.**					
Storm 4S (*bentazon* + *acifluorfen*)	1.5 pt	0.5 + 0.25 lb	6 + 14	75 days	48 hours
Comments: STORM controls morningglories, cocklebur, prickly sida, ragweed, eclipta, tropic croton, and several other broadleaf weeds with less injury than BLAZER alone. Application must be made to small, actively growing weeds (i.e., ALS resistant Palmer amaranth <4 inches). Include NIS or COC. Can be mixed with 2,4-DB for control of larger weeds and for improved control of sicklepod. May be tank-mixed with GRAMOXONE. **Rainfast interval is 4 hours.**					

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Strongarm 84WDG (*diclosulam*)	0.45 oz	0.024 lb	2	30 days	12 hours

Comments: Apply STRONGARM from cracking to the initiation of flowering (bud stage), but no later than 30 days after planting. The optimum growth stage to apply STRONGARM for Benghal dayflower control is at the 1- to 2-leaf growth stage and actively growing. Add a non-ionic surfactant at 1 qt per 100 gal of spray solution. STRONGARM maybe tank mixed with other postemergence herbicides labeled for peanut. Do not apply more 0.45 oz/A of STRONGARM from all use patterns (preemergence, preplant incorporated, and postemergence applications) per season. STRONGARM may cause temporary yellowing or chlorosis of peanut foliage after application and symptoms will vary according to environmental and crop growth factors.

Ultra Blazer 2S (*acifluorfen*)	0.5-1.5 pt	0.125-0.38 lb	14	75 days	48 hours

Comments: ULTRA BLAZER provides control of morningglories, tropic croton, wild radish, and wild poinsettia. Adjust use rate according to weed size and species as noted on the label. Use 1.0 pt/A or less for control of highly sensitive species, such as hemp sesbania and showy crotalaria. Slight to moderate peanut foliage burn may result. Do not apply more than 2 pt/A per season as a postemergence treatment. Apply with NIS at 1 qt/100 gal spray solution (0.25% v/v). Allow a minimum of 15 days between sequential applications. May be tank-mixed with 2,4-DB (1 pt/A). ULTRA BLAZER + 2,4-DB tank mixture is generally more injurious to peanuts than either product alone. May be tank-mixed with BASAGRAN for control of broadleaf weeds such as morningglories, cocklebur, and prickly sida. Pre-packaged mix of acifluorfen + bentazon is available as STORM. Do not use treated peanut vines for feed or forage. **Rainfast interval is 4 hours.**

Warrant 3ME (*acetochlor*)	1.25-2.0 qt	1.125-1.5 lb	15	90 days	12 hours

Comments: WARRANT provides residual control of small seeded broadleaves (including ALS-resistant Palmer amaranth) and grasses. Apply after crop emergence and before flowering but before weeds germinate. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Allow at least 7 days between sequential applications. WARRANT may be tank mixed with GRAMOXONE, FIRESTORM, PARAZONE, CADRE, COBRA, PARAQUAT, STORM, ULTRA BLAZER, or 2,4-DB to expand spectrum of weed control or for control of emerged weeds at time of application. Environmental conditions that follow application of WARRANT including cold, wet soils or water logged conditions from excessive rain may result in crop injury.

2,4-DB			4	30 days	48 hours
(Butyrac 175) 1.75S	14-18 fl oz	0.19-0.25 lb			
(Butyrac 200) 2.0S	13-16 fl oz	0.20-0.25 lb			
(Butoxone 175) 1.75S	16-28 fl oz	0.22-0.38 lb			
(Butoxone 200) 2.0S	14-26 fl oz	0.22-0.40 lb			

Comments: Apply up to 2 applications per season as an over-the-top treatment for broadleaf weed control. Use rates and application timing varies by specific product label. For control of morningglory and citronmelon, apply in the seedling stage. Cocklebur one foot or more in height can be controlled; however, earlier treatment is preferred. Effective for control of escaped sicklepod. Do not apply if peanuts are under drought stress. BUTYRAC may be applied up to 12 weeks after planting. Do not apply BUTOXONE within 30 days of harvest. Research indicates no adverse effects of adding chlorothalonil products with 2,4-DB where fungicide treatments are needed. Do not tank-mix with postemergence grass herbicides. **Rainfast interval is 1 hour.**

Non-Selective Applicator for Peanut

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone 2SL (*paraquat*)	0.67 pt	0.25 lb	22	15 days	12 hours

Comments: Paraquat is a RESTRICTED USE PESTICIDE. Mix 1 part PARAQUAT with 2 parts water to prepare a 33% solution. Add non-ionic surfactant at 0.25% v/v of the finished volume. Apply up to 2 pt/A of the herbicide:water mixture. Apply through a non-selective applicator, such as recirculating rope or carpet roller, for suppression and/or control of ALS-resistant Palmer amaranth and/or to prevent seed production (application must be made before appearance of seed heads). Make application when target weed(s) have sufficient height differential with the peanut canopy and set equipment to minimize dripping. Low ground speed (5 mph or less) enhances coverage and activity of PARAQUAT. **Rainfast interval is 30 minutes**.

Harvest Aids for Peanut

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.0-2.0 oz	0.016-0.031 lb	14	7 days	12 hours

Comments: Apply AIM for late-season desiccation/defoliation of annual morningglories. AIM is less effective on smallflower morningglory. Use in combination with either a NIS (0.25% v/v) or COC (1% v/v). AIM may cause peanut leaf spotting or burning. Use at least 15 GPA for optimum results. Do not graze or feed peanut hay to livestock. Only 1 application per season is permitted. **Rain-free period is 6 to 8 hours.**

ET 0.208EC (*pyraflufen ethyl*)	1.0-2.0 fl oz	0.0016-0.0032 lb	14	7 days	12 hours

Comments: Apply ET for late season desiccation/defoliation of annual morningglories. Use a NIS at 0.25% v/v (1 qt/100 gals). Apply in a minimum of 5 gallons spray solution per acre by air or 10 gallons spray solution per acre by ground. Allow a minimum of 30 days between applications. Use higher product rate for larger weeds. Do not make more than 2 applications or exceed 4.0 fl oz/acre for all in-season applications combined. **Rainfast interval is 1 hour.**

Herbicide Programs for Control of Benghal Dayflower in Peanut

Program 1

*a) Preemergence **Immediately After Planting (before BENGHAL DAYFLOWER is emerged):** Apply Valor @ 3 oz/A + Dual Magnum or generic metolachlor (Stalwart, Parallel PCS, Me-Too-Lachlor) @ 1 pt/A or Warrant @ 3 pt/A,*
followed by:
*b) **Postemergence application when BENGHAL DAYFLOWER is 1-2" tall:** Apply Cadre/Impose 2L @ 4 oz/A + Dual Magnum or generic metolachlor (Stalwart, Parallel PCS, Me-Too-Lachlor) @ 1pt/A.*

Program 2

*a) **Early Postemergence (before 28 days after peanut cracking):** Apply Gramoxone SL@ 12 oz/A or Firestorm/Parazone @ 8 oz/A + Storm at 1 pt/A + Dual Magnum or other generic metolachlor product @ 1 pt/A or Warrant @ 3 pt/A,*
followed by:
*b) **POST (2-3 weeks after at-crack spray, but before BENGHAL DAYFLOWER is 1-2" tall)):** Apply Cadre @ 4 oz/A + Dual Magnum or generic metolachlor (Stalwart, Parallel PCS, Me-Too-Lachlor) @ 1 pt/A.*
**When using Dual Magnum or generic metolachlor POST in combination with Cadre/Impose, Gramoxone/Firestorm, or Strongarm, additional spray adjuvants (NIS, COC) are not necessary.*

Application Timing and Growth Stages for Grass Herbicides in Peanut

	Fusilade DX	**Poast**	**Poast Plus**	**Select**	**Select Max**
Maximum Rate/A/*Season*	48 oz	2.5 pt	3.75 pt	32 oz	64 oz
Maximum Rate/A/*Application*	24 oz	1.5 pt	2.25 pt	16 oz	32 oz
broadleaf signalgrass	12 oz (2-4″)	1.0 pt (up to 8″)	1.5 pt (up to 8″)	6-8 oz (2-6″)	9-16 oz (2-6″)
crabgrass	12 oz (1-2″)	1.0 pt (up to 6″)	1.5 pt (up to 6″)	6-8 oz (2-6″)	9-16 oz (2-6″)
crowfootgrass	-------- weed not found on label --------			6-8 oz (2-6″)	9-16 oz (2-6″)
sandbur	12 oz (2-4″)	1.25 pt (up to 3′)	1.875 pt (up to 3″)	6-8 oz (2-6″)	9-16 oz (2-6″)
goosegrass	8 oz (2-4″)	1.0 pt (up to 6″)	1.5 pt (up to 6″)	6-8 oz (2-6″)	9-16 oz (2-6″)
fall panicum	12 oz (2-6″)	1.0 pt (up to 8″)	1.5 pt (up to 8″)	6-8 oz (2-8″)	9-16 oz (2-8″)
Texas panicum	12 oz (2-8″)	1.0 pt (up to 8″)	1.5 pt (up to 8″)	6-8 oz (2-6″)	9-16 oz (2-6″)
rhizome johnsograss	12-24 oz (1st) (8-18″) 8-24 oz (2nd) (6-12″)	1.5 pt (1st) (up to 25″) 1.0 pt (2nd) (up to 12″)	2.25 pt (1st) (up to 25″) 1.5 pt (2nd) (up to 12″)	8-16 oz (1st) (12-24″) 6-8 oz (2nd) (6-18″)	12-32 oz (1st) (12-24″) 9-24 oz (2nd) (6-18″)
bermudagrass	12-24 oz (1st) (4-8″ runners) 8-24 oz (2nd) (4-8″ runners)	1.5 pt (1st) (up to 6″ stolon) 1.0 pt (2nd) (up to 4″ stolon)	2.25 pt (1st) (up to 6″ stolon 1.5 pt (2nd) (up to 4″ stolon	8-16 oz (1st) (3-6″ runners) 8-16 oz (2nd) (3-6″ runners	12-32 oz (1st app) (3-6″ runners) 12-32 oz (2nd) (3-6″ runners)

PEANUT INSECT MANAGEMENT

Dan Anco, Extension Peanut Specialist

See the following tables for insect control recommendations, active ingredient concentrations and use precautions. In many cases, controlling peanut volunteers in rotation years helps prevent insect population buildup and damage in the following year.

Thrips cause serious crop stunting and yield loss from both direct feeding and virus transmission (tomato spotted wilt). All commercial peanuts planted in S. C. should be treated at planting with a preventative in-furrow insecticide (Thimet 20G). Admire Pro in-furrow (10 fl oz) can also be used for thrips control; however, since Admire Pro actually often increases virus, it benefits from being paired with highly virus-resistant varieties (e.g., Bailey, Sugg, Sullivan). Immediate foliar application of Orthene is recommended if in-furrow treatment fails to prevent thrips stunting.

Soil Insects:

Lesser cornstalk borers attack pods, pegs, lateral stems and the crown at the soil line during extended drought stress. Fields with lighter soils are particularly vulnerable. In addition to losses from direct injury, LCB damage is associated with increased white mold and aflatoxin levels due to the wounds it causes. Rapid canopy closure and reduced soil temperatures lower LCB risk. **Irrigation is the best defense against lesser cornstalk borer.** Granular Lorsban (13 lb/A) can be applied at pod set (about 50 – 55 DAP) to high risk fields (sandy soils under drought stress). About 1/4" rain/irrigation is needed within 10 days of application for Lorsban to be effective. Lorsban also reduces pod damage from wireworm, burrower bugs, and southern corn rootworm feeding. Unfortunately, Lorsban kills predatory insects and causes outbreaks of corn earworm, granulate cutworm and spider mites under drought stress later in the season. Late fall tillage before planting covers can help reduce but will not eliminate LCB winter survival. LCB damage is typically less severe under reduced-tillage.

Burrower bugs primarily attack reduced-tillage peanut fields under drought stress. These are essentially underground stink bugs which feed directly on kernels by piercing pods with their needle-like mouthparts. In addition to direct yield and grade loss (reduced kernel weight), burrower bug damage can lead to Seg. II loads and increased aflatoxin levels (Seg. III). **Irrigation is also the best defense against burrower bug injury.** Late fall tillage can help reduce but will not eliminate burrower bug winter survival. Lorsban application can significantly reduce burrower bug damage but must be applied preventatively (July). Lorsban is not routinely recommended for managing burrower bug (see LCB comments above about associated outbreaks).

Wireworms are immature or larval stages of click beetles that commonly feed on peanut pods. Although wireworms are capable of causing significant injury, thus far economic damage to peanut has been minimal under S. C. conditions. The only practical treatment for wireworms is preventative Lorsban application.

Southern corn rootworm is the immature stage of the eleven-spotted cucumber beetle. This worm tunnels into peanut pods under high soil moisture conditions, usually in more organic soils such as found in bottom areas, particularly under irrigation. Rootworm injury has been a relatively minor concern thus far under S. C. conditions. Preventative granular Lorsban is the only practical treatment for rootworms.

Foliage Caterpillars:

Corn earworm is the most common foliage feeding insect on peanuts. Corn earworms usually appear in peanut fields during the last week of July or first week of August after the moths emerge from corn fields. Corn earworms initially feed in plant terminals, then blooms, older leaves and pegs as they mature. It is difficult to separate corn earworm from tobacco budworm with the naked eye; several non-pyrethroid products are effective on both.

Fall armyworms are not usually an economic problem on peanut, but they can occur in very high numbers during outbreak years. Infestations typically occur in mid-August, a couple weeks after corn earworms first appear.

Granulate cutworm can defoliate small plants in June and can also be a problem late in August where Lorsban was previously used because Lorsban kills fire ants and other predators. Granulate cutworms have distinctive Chevron or "sergeant stripe" markings along the back. Granulate cutworms initially feed on blooms, then leaves, pegs and pods as they mature. During the day cutworms can be found curled up under shed leaves and other organic matter on the soil

surface. The larvae climb up the plant at night to feed. Symmetrical feeding damage (from feeding when the leaves are folded at night) is a clue to look for granulate cutworms on and in the soil.

Velvetbean caterpillars can rapidly defoliate late maturing peanuts during late September or October in southern coastal plain counties of S. C, especially Jasper, Hampton, Allendale and Colleton counties. Velvetbean caterpillars range from light green to almost black. A key characteristic is medium to large worms thrash violently when handled. Moths land with their wings out and have a line that stretches wing tip to wing tip. They are easy to control.

Scouting for Foliage Caterpillars:

Use a 3' shake cloth to look for worms starting the last week of July. Work the dowel handle up under lateral stems to the plant crown and bend the other side of the plants over the cloth. Beat down vigorously 15 times to knock worms onto the cloth. Shake the plants, bend them back out of the way and count the worms on the cloth. Also count worms under the cloth on both sides of the row to calculate worms/row ft. Check at least three areas/field.

Rank-growing, unstressed peanuts with a closed canopy can tolerate 8 foliage feeding worms per row ft. The treatment threshold is 4 worms per row ft on stressed plants which have not lapped the middle or where Lorsban has previously been applied. Runner varieties with slow growing canopies can be more susceptible to direct injury from foliage feeding. Weed control may also be affected by delayed canopy closure on runner varieties. **Irrigation, vigorous canopy growth, and avoidance of unnecessary early season insecticide applications are the best defense against foliage-feeding worms.**

Spider mites can damage drought stressed peanuts in August and September. Stressed fields should be spot checked for yellow "hits" indicating where mites are feeding. Spider mites can be seen with a hand lens on the underside of leaflets. Webbing may be present with heavy infestation. These twospotted spider mites get their name from the two spots (one on each side) on their body. Mite suppression requires ground application, thorough coverage, and potentially a second application in 5-7 days. Lorsban or pyrethroid application greatly increases the risk of mite outbreaks. **Irrigation is the best defense against spider mite injury.**

PEANUT INSECT CONTROL

Sucking/Piercing/Rasping Pests			
Insect	**Product**	**Rate/A**	**Comments**
Thrips In-furrow	Thimet 20G	4.7 lb (38" rows)	Preventative in-furrow thrips control is a must on all peanuts planted in S.C. Maximum labeled Thimet rate is 5.5 oz/1,000 row ft, equivalent to 4.7 lb/A on 38", 5.0 lb on 36", and 6.0 lb on 30" rows. Twin rows: use 3.5 oz/1,000 row ft in each row, which equals 6.0 lb/A on 38" centers. **Admire Pro and Velum Total control thrips but usually increase tomato spotted wilt virus. Use only on highly virus-resistant varieties (e.g., Bailey, Sugg, Sullivan).** Twin rows: max labeled rate for Admire Pro is 10.5 fl oz/A/season. Splitting 5 fl oz into each row will usually require follow up with foliar Orthene for adequate thrips suppression.
	Admire Pro	10 fl oz	
	Velum Total	18 fl oz	
	AgLogic 15G	7 lb	
Thrips Foliar	Orthene 75S Orthene 97SP Diamond 0.83EC	0.5-1.0 lb 0.375-0.75 lb 6-12 fl oz	Apply foliar Orthene immediately if in-furrow treatments do not prevent thrips stunting. Diamond suppresses immature thrips; it will not control adults.

Insect	Product	Rate/A	Comments
Leafhoppers	Orthene 75S	0.6-1.0 lb	Hopperburn starts on field borders usually in June - July. Treat if hopperburn is spreading across the field and approaching 15-20% symptomatic leaflets. Bailey and Sugg varieties are particularly susceptible to hopperburn.
	Orthene 97SP	0.5-0.75 lb	
	Pyrethroids		
	Asana XL 0.66EC	3.9 fl oz	
	Baythroid XL 1EC	1.0-1.8 fl oz	
	Besiege 1.25 SC*	5.0-8.0 fl oz	
	Brigade 2EC	2.1-6.4 fl oz	
	Declare 1.25CS	1-1.5 fl oz	*Besiege is a pyrethroid + diamide mix. For control of both hoppers and worms, use worm rates below.
	Karate Z 2.08CS	1.0-1.6 fl oz	
	Mustang Max 0.8EC	1.75-4 fl oz	
	Proaxis 0.5CS	1.9-3.2 fl oz	
Spider mites	Comite II	2.25 pt	Use ground application, 20 gal/A at 40-60 psi. Repeat appl. after 5-7 days. Lorsban or pyrethroids can cause mite outbreaks. Avoid unnecessary worm insecticides to reduce mite risk**. Irrigation is the best mite defense.** Use of pyrethroids labeled for spider mite control (e.g., Danitol) is <u>not</u> recommended.
	Omite 30WS	3-5 lb	
Three-cornered alfalfa hopper	Orthene 75S	0.65 lb	Treat at 45-60 days after planting to prevent injury.
	Orthene 97SP	0.5 lb	
	Pyrethroids		
	Baythroid XL 1EC	1.8-2.4 fl oz	
	Besiege 1.25 SC*	5.0-8.0 fl oz	
	Brigade 2EC	2.1-6.4 fl oz	
	Declare 1.25CS	0.8-1.3 fl oz	*Besiege is a pyrethroid + diamide mix. For control of both hoppers and worms, use worm rates below.
	Karate Z 2.08CS	1.0-1.6 fl oz	
Foliage Feeding Worms			
Beet armyworm, Fall armyworm, Soybean looper	Belt 4 SC	2-4 fl oz	Unstressed plants with a large, closed canopy can tolerate 8 total worms/row ft. Treat if populations reach 4/row ft on drought stressed, unlapped peanuts or on fields previously treated with Lorsban. Fall armyworm attacks peanut in outbreak years from mid-August to early September. Loopers seldom significantly defoliate peanuts by themselves but typically occur with other defoliators. If Besiege or Coragen are used for loopers or beet armyworms, use the maximum labeled rate.
	Besiege 1.25 SC	6-10 fl oz	
	Blackhawk 36 WDG	1.7-3.3 oz 3.5-	
	Coragen 1.67 SC	5.0 fl oz	
	Diamond 0.83EC	6-12 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Prevathon 0.43 SC	14-20 fl oz	
	Radiant 1 SC	3-8 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
Corn earworm	Belt 4 SC	2-4 fl oz	Same threshold as for beet armyworm. Peanuts can often withstand significant defoliation (at least 30%) prior to pegging. We have not measured any yield response to treating early season earworm infestations. However, weed control on small canopy runners may be affected by delayed canopy closure. **Corn earworm is difficult to separate from tobacco budworm with the naked eye; several non-pyrethroid products are effective against both.**
	Besiege 1.25 SC	6-10 fl oz	
	Blackhawk 36 WDG	1.7-3.3 oz	
	Coragen 1.67 SC	3.5-5.0 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Lannate 2.4 LV	12-18 fl oz	
	Lannate 90 SP	0.25-0.38 lb	
	Prevathon 0.43 SC	14-20 fl oz	
	Radiant 1 SC	3-8 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
	Pyrethroids		
	Asana XL 0.66 EC	3.9-5.8 fl oz	
	Baythroid XL 1EC	1.8-2.4 fl oz	
	Brigade 2 EC	2.1-6.4 fl oz	
	Danitol 2.4 EC	10.6-16 fl oz	
	Declare 1.25 CS	1.0-1.5 fl oz	

Insect	Product	Rate/A	Comments
Corn earworm (continued)	**Pyrethroids**		
	Karate Z 2.08CS	1.3-1.9 fl oz	
	Mustang Max 0.8EC	3.2-4 fl oz	
	Proaxis	2.5-3.8 fl oz	
Tobacco budworm	Belt 4 SC	2-4 fl oz	Same threshold as for beet armyworm. Peanuts can withstand significant defoliation (at least 30%) prior to pegging. We have not measured any yield response to treating early season budworm infestations. However, weed control on small canopy runners may be affected by delayed canopy closure. See corn earworm comment.
	Besiege 1.25 SC	6-10 fl oz	
	Blackhawk 36 WDG	1.7-3.3 oz 3.5-	
	Coragen 1.67 SC	5.0 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Prevathon 0.43 SC	14-20 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
Velvetbean caterpillar	Belt 4 SC	2-4 fl oz	Velvetbean caterpillar is a late season pest (Sep - Oct) that can defoliate peanuts quickly. This pest is usually easy to control but often misidentified as an armyworm, leading to unnecessary treatment cost.
	Besiege 1.25 SC	5-8 fl oz	
	Blackhawk 36 WDG	1.7-3.3 oz	
	Coragen 1.67 SC	3.5-5.0 fl oz	
	Diamond 0.83EC	6-8 fl oz	
	Dimilin 2L	2.0 fl oz	
	Intrepid Edge 3F	4-8 fl oz	Adding Dimilin 2L (2 fl oz/A) to the last fungicide treatment will prevent VBC in high risk areas (southern coastal plain counties). **Do not use Dimilin to control established populations.**
	Radiant 1 SC	3-8 fl oz	
	Pyrethroids		
	Asana XL 0.66 EC	3.9-5.8 fl oz	
	Baythroid XL 1EC	1.8-2.4 fl oz	
	Brigade 2 EC	2.1-6.4 fl oz	
	Danitol 2.4 EC	10.6-16 fl oz	**Note:** Steward is one of the few insecticides that <u>will not</u> control velvetbean caterpillar.
	Declare 1.25 CS	1.0-1.5 fl oz	
	Karate Z 2.08 CS	1.3-1.9 fl oz	
	Mustang Max 0.8EC	1.3-4 fl oz	
	Proaxis 0.5 CS	2.5-3.8 fl oz	
Soil Insects			
Burrower bug,	Lorsban 15 G	13.3 lb	Apply Lorsban 15G with a 5" bander directly over the row the first week of July. Some rain (~0.2") is needed within 10-14 days of application to be effective. Lorsban often causes spider mite and worm outbreaks. Burrower bug injury almost always occurs in reduced tillage fields under severe late season (Aug to early Sep) drought stress. Lesser cornstalk borer injury only occurs under severe drought stress. **Irrigation is the best defense against burrower bug or lesser cornstalk borer injury.**
Lesser cornstalk borer,	Lesser cornstalk borer and southern corn rootworm:		
Southern corn rootworm,	Besiege 1.25 SC	10 fl oz	
	Diamond 0.83EC	6-12 fl oz	
Wireworms			
	Wireworms only:		Current data is limited on Besiege and Diamond efficacy on lesser cornstalk borer – apply at first signs of feeding to before pests reach damaging levels.
	Lorsban 4E (at planting)	4 pt	
Granulate cutworm	Belt 4 SC	2-4 fl oz	Treat if defoliation exceeds 30% on small plants in June or about 50-55 DAP. Previous Lorsban treatment triggers cutworm outbreaks in August. Granulate cutworms are now resistant to pyrethroids.
	Besiege 1.25 SC	8-10 fl oz	
	Coragen 1.67 SC	4-5.0 fl oz	
	Prevathon 0.43 SC	20 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
Note: there are many generic insecticide brands, particularly for pyrethroids. For equivalent rates compare active ingredient concentrations to the following table. Also see pre-harvest interval and use precautions. The label is the law. Always read and follow all pesticide label restrictions.			

PEANUT INSECTICIDE ACTIVE INGREDIENTS & USE PRECAUTIONS

Active ingredient	Brand name and formulation	IRAC* Group	PHI (Days)	Comments
Acephate	**Orthene** 75S **Orthene** 97SP	1B	14	Do not feed or graze.
Aldicarb	**AgLogic** 15G	1A	90	Do not feed or graze. Do not exceed 17 lb/A/season.
Chlorantraniliprole	**Prevathon** 0.43 SC	28	1	Do not exceed 4 appl. or 60 fl oz/A/season.
Chlorpyrifos	**Lorsban** 15G	1B	21	Do not exceed 26.6 lb/A/season.
Diamides				
Chlorantraniliprole	**Coragen** 1.67 SC	28	1	Do not exceed 4 appl. per season.
Chlorantraniliprole + lambda-cyhalothrin	**Besiege** 1.25 SC	28 3A	14	Do not exceed 31 oz/A/season.
Flubendiamide	**Belt** 4 SC	28	3	Do not exceed 12 fl oz/A/season.
Diflubenzuron	**Dimilin** 2L	15	28	Do not exceed 3 appl. per season.
Imidacloprid	**Admire Pro** 4.6F **Velum Total** 2.17F	4A	14	Increases tomato spotted wilt virus; use only on highly resistant varieties. Do not feed or graze.
Indoxycarb	**Steward** 1.25 SC	22	14	Do not exceed 45 fl oz/A/season.
Methomyl	**Lannate** 2.4 LV **Lannate** 90 SP	1A	21	Do not feed or graze.
Methoxyfenozide + spinetoram	**Intrepid Edge** 3F	18 5	7	Do not exceed 3 appl./season. Max 1 lb methoxyfenozide or 0.188 lb spinetoram/A/season. Do not feed or graze.
Novaluron	**Diamond** 0.83EC	15	28	Do not exceed 36 fl oz/A/season. Do not feed or graze.
Phorate	**Thimet** 20G	1B	90	Do not exceed 5.5 oz/1000 row ft or 7.5 lb/A. Do not feed or graze.
Propargite	**Comite II** 6 EC **Omite** 30WS	12C	14	Do not exceed 2 appl. per season. Do not feed or graze.
Pyrethroids				
Beta-cyfluthrin	**Baythroid XL** 1 EC	3A	14	Do not exceed 0.066 lb ai/A/season.
Bifenthrin	**Brigade** 2 EC		14	Do not exceed 0.5 lb ai/A/season. Do not feed or graze.
Esfenvalerate	**Asana XL** 0.66 EC		21	Do not feed or graze.
Fenthropathrin	**Danitol** 2.4 EC		14	Do not feed forage or hay within 14 days of treatment. Do not exceed 2.66 pt/A/season.
Gamma-cyhalothrin	**Declare** 1.25 CS **Proaxis** 0.5 CS		14	Do not exceed 0.38 pt/A (Declare) or 0.96 pt/season (Proaxis).
Lambda-cyhalothrin	**Karate Z** 2.08 CS		14	Do not feed or graze.
Zetamethrin	**Mustang Max** 0.8EC		7	Do not exceed 0.15 lb ai/A/season. Do not feed or graze.
Spinetoram	**Radiant** 1 SC	5	3	Do not exceed 3 appl. per season. Do not feed or graze.
Spinosad	**Blackhawk** 36 WDG	5	3	Do not exceed 9 fl oz/A/season.

*IRAC group number (Insecticide Resistance Action Committee) indicates mode of action. Repeated pest exposure to the same mode of action increases the risk of insecticide resistance.

Note: there are many generic insecticide brands, particularly for pyrethroids. For equivalent generic rates compare active ingredient concentrations to this table. The label is the law. Always read and follow all pesticide label restrictions.

PEANUT DISEASE MANAGEMENT

Dan Anco, Extension Peanut Specialist

Seedling Diseases:
All peanut seed should be treated with a fungicide to reduce the incidence of seed-transmitted and soilborne seedling diseases such as Aspergillus crown rot, Cylindrocladium, Pythium and Rhizoctonia. **Dynasty PD** (mefenoxam + fludioxonil + azoxystrobin), **Rancona V PD** (ipconazole + carboxin + metalaxyl), **Vitavax PC** (Captan + PCNB + carboxin), **Trilex Star** (Captan + trifloxystrobin + metalaxyl + thiophanate-methyl), and **Trilex Optimum** (Captan + trifloxystrobin + metalaxyl) seed treatments are all effective in reducing seedling disease and protecting stand counts. Adequate stand counts reduce the risk of tomato spot wilt virus.

Tomato spotted wilt virus (TSWV):
This virus is transmitted to peanuts by thrips, primarily tobacco thrips. TSWV stunts plants, reduces yield and causes shriveled, misshapen pods. All peanut fields in S. C. are vulnerable to yield loss from TSWV regardless of whether the farm has any history of peanut production.

A 6-step program is recommended to reduce Tomato Spotted Wilt:

Using more of these together will improve chances of minimizing TSWV risk and yield loss.

1. **Varietal Resistance** – Varieties with partial resistance to TSWV are listed in the variety characteristic chart of the peanut production guide. No variety is immune.

2. **Planting Date Window** – Early planting (Late April – 10 May) has greater risk of virus infection, but with large acreage, we must start planting the first week of May. Late planting (1 June) may also increase virus risk.

3. **Plant Population/Seeding Rate** – The goal is a uniformly emerged stand of 4 plants per row ft. Plant 6 seeds/row ft (or at least 5/row ft for large seeded Virginia types) into good soil moisture. Uniform emergence and vigorous early growth reduce virus risk.

4. **Insecticide Treatment** – Apply in-furrow treatments of Thimet 20G (4.7 lb/A on 38" rows) to all fields. See insecticide table for phorate rates by row spacing. Admire Pro (10 fl oz in-furrow) or Velum Total (18 fl oz/A) tank mixed with inoculant is an alternative for preventing thrips stunting under low virus risk (e.g., Bailey, Sugg). However, imidacloprid (Admire Pro or Velum Total) usually increases severity of virus infections.

If thrips are stunting peanut seedlings, treat immediately with acephate: Orthene 75S (0.5-1.0 lb/A) or Orthene 97SP (6-12 oz/A).

5. **Strip-tillage** – Surface crop residue reduces the number of thrips landing in peanut fields, in turn reducing virus infection.

6. **Twin-row planting** – faster ground cover reduces virus risk. Twin-row planting requires a specialized planter.

Tomato Spotted Wilt management is mostly over when the planter leaves the field.

Late Leaf Spot:
Foliar disease control programs for S. C. are targeted primarily at **late leaf spot** (*Cercosporidium personatum*) because this disease most consistently causes economic loss. Late leaf spot spores can be carried for many miles in the wind and therefore any field is at some risk regardless of peanut history. However, field history greatly affects late leaf spot risk because leaf spot spores persist on peanut residue in the soil. All fields should be rotated out of peanut for a minimum of two years to reduce late leaf spot pressure. Adjacent fields which had poor late leaf spot control at the end of the previous season can also be a source of significant infection, especially if upwind. Fortunately, other row crops and weeds are not significant hosts for late leaf spot. Late leaf spot is diagnosed by the black spores on the underside of dark brown to black lesions on leaves. Yellow halos may or may not surround late leaf spot lesions.

Other foliar fungal diseases include **early leaf spot, pepper spot, web blotch and rust.** There are also several physiological leaf spot symptoms which commonly occur, often in response to stress, such as "**irregular leaf spot**". Physiological leaf spots do not respond to fungicides and can be difficult to distinguish from fungal diseases in the field. The best and simplest management approach is that if our fungicide program is good enough to prevent the most common and aggressive disease (late leaf spot), then we will usually be OK on the other foliar diseases.

Risk factors for late leaf spot:
- Short rotations (less than 2 years out of peanuts)
- Highly susceptible variety (e.g., Champs, Georgia 13M, Gregory, Spain, TUFRunner 511)
- Late planting (May 26 and later)
- Poor control of volunteer peanuts in rotational crops
- Poor end of season control of late leaf spot in an adjacent upwind field the previous year
- Starting fungicide programs any later than 45 DAP; better a little early than late
- Extending spray intervals beyond 15 days
- Repeated, frequent periods of leaf wetness: excessive rain, frequent irrigation
- Rain off immediately after application – wait 24 h to irrigate
- Consecutive use of fungicides with the same mode of action (except chlorothalonil)

Importance of Chlorothalonil (Bravo and generics): Chlorothalonil is the foundation of peanut leaf spot control programs because it is the only product proven to have multiple modes of action to reduce the risk of developing leaf spot resistance. Multiple sequential chlorothalonil applications have been used for over 40 years without resistance development. Alternating or tank mixing chlorothalonil with other products can delay development of resistance towards those alternative compounds. Chlorothalonil in the last spray (105 or 120 DAP) can also help prevent resistant leaf spot strains from overwintering and causing infection in the following year.

Alternative to Calendar Spray Programs: An alternative to calendar-based leaf spot sprays is to spray based on weather. General rules for weather-based application are: First spray: treat when 5 daily rain events (≥ 0.1") have occurred since cracking. Each subsequent spray: wait 10 days since the last application, then treat whenever 2 rains occur after the 10-day interval. However, under S. C. conditions, the importance of applying preventative soil disease treatments before rain events has made calendar-based programs more effective for most growers.

Slowing a Growing Leaf Spot Epidemic: Effective fungicide programs are designed to prevent disease, not "cure" it after the fact. If something goes wrong and you find late leaf spot lesions in the bottom of the canopy (particularly with > 30 days until harvest) treat immediately with Topsin 4.5FL 10 fl oz + 1.5 pt Bravo, Provost Opti 10.7 oz + Bravo 1.5 pt, or Priaxor 8 fl oz. Retreat in 10 days.

White Mold:
White mold (*Sclerotium rolfsii*) is the most consistently damaging soil disease under S. C. conditions. This fungus invades peanut lateral branches in contact with the soil, as well as pods and pegs. White mold infections are driven primarily by high soil temperatures and humidity. Dry weather offers no protection from white mold. Drought can prevent infection from being noticed aboveground, but infection underground on pegs and pods can continue where it may not be noticed until harvest. Our most severe white mold outbreaks often occur under drought with excessive canopy temperatures.

Symptoms include dark brown lesions on stems and pods, rotted pods and pegs, wilting of individual or multiple stems and plant death. Unless severely infected, tap roots generally remain intact and flexible with white mold, whereas CBR infection decays tap roots much quicker.

Signs: Mycelium of *S. rolfsii* is white and produces a fan-like growth as it spreads. The resting stage of white mold (sclerotia) persists in the soil from year to year making rotation out of host crops (peanut, soybean and other legumes including many weeds) highly important. Sclerotia are small (< 5/64" = 2 mm), round structures that are initially white and later become tan to dark brown. With ample moisture, sclerotia can be found on infected peanut tissues or leaf litter. **Note:** A similar looking fungus, false white mold (*Phanerochaete*), also produces white mycelium and can be found in peanut fields. False white mold does not produce sclerotia and does not damage peanuts; if it is found on peanuts and scraped away, tissue beneath it will look healthy.

Risk factors for white mold:
- Peanut or soybean history
- Less than 2 years rotated out of peanut, soybean or other legume
- Any variety other than Bailey, Sullivan, Sugg, Wynne or Georgia 12Y should be considered highly susceptible. Georgia 07W and TUFRunner 511 also show some tolerance though not as good as the previous group.
- Early planting (first week of May or earlier); delaying planting until mid-May may help suppress white mold due to higher seedling soil temperatures and faster early root growth
- Lack of rain preventing fungicide from being washed into the soil
- Extended, unusually hot temperatures in July and August

Variety resistance (particularly Bailey, Sugg, Sullivan and Georgia 12Y) is far more effective than any chemical treatment in suppressing white mold. These varieties typically control white mold with standard fungicide programs.

Early Season Banded Sprays: Banded application of Proline (38" rows: 5.5 fl oz/A in 20 gal/A on 12" band) OR Elatus (38" rows: maximum 8.9 oz/A in ≥ 10 gal/A, 7 – 10" band) to peanut seedlings at 21 – 35 DAP can improve white mold control under extreme disease pressure. See table on Early Season Band Treatment Options for row-spacing banded rates. **Note:** In-furrow fungicide treatments have not been effective in suppressing white mold (see details below regarding CBR control). See following tables for fungicide efficacy and comments.

Night/Pre-Dawn Spraying: Peanut plants fold their leaves at night making it easier for soil fungicide treatments to reach the base of the plant and soil surface. Applying white mold treatments at night has been shown to increase control effectiveness, at least under severe white mold pressure. If Bravo (a non-systemic) is being relied on for leaf spot control, control of this foliar disease may be reduced with night spraying because of reduced leaf coverage. For growers interested in trying night applications, we recommend the 60, or 60 and 75 DAP treatments as priorities.

Cylindrocladium Black Rot (CBR):
CBR is caused by a soil fungus (*Cylindrocladium parasiticum*) that occurs in the same field areas from year to year, often in low spots. CBR is transmitted from field to field by contaminated seed and equipment. **Rotation**

(≥ 2 years out of peanuts and elimination of soybean from the rotation) and **resistance** are the best defenses against severe CBR. Rotation alone will not eliminate significant injury.

Symptoms and signs: When first infected, peanut plants can turn light green or yellow. As CBR infections progress, peanut stems or entire plants wilt and eventually die. CBR rots roots, including the tap root, causing them to turn black and fall apart (tap roots infected by white mold remain intact and flexible much longer). Under drier conditions, symptoms of CBR infection may be limited to chlorotic yellowing and plant stunting. Following moist conditions, brick-red reproductive structures (perithecia) might appear on crowns, lower stems, pegs and pods. Infected seed can develop cinnamon-colored speckles (microsclerotia) on seed coats before rotting.

Risk factors for CBR:
- Confirmed history of economic CBR loss in the field
- Soybean or peanut history
- Short rotations out of peanut, soybean or other legumes
- Poorly drained, more organic soils such as found in low areas of a field
- Any variety other than Bailey, Perry or Sugg (Champs is particularly susceptible to CBR)
- Lack of control over seed source (seed transmission)
- Early planting (April); delaying planting until mid-May may help suppress CBR due to higher seedling soil temperatures and faster early root growth

CBR Control:
Variety resistance (Bailey) is far more effective than any chemical treatment in suppressing CBR. Bailey often adequately suppresses CBR without fumigation or in-furrow fungicides.

On susceptible varieties in fields with a proven history of CBR loss, use **Propulse** (13.6 fl oz/A) OR **Proline** (5.7 fl oz/A) **in-furrow** (with inoculant)**,** OR **fumigate with Vapam (10 gal/A).** Vapam must be shanked into a bed at ~10" depth 14 days prior to planting. Soil temperature at 4" depth should be at least 60º F. Avoid fumigating when there is a high risk of heavy rain (> 1.0") within 2 days. See the following tables for fungicide efficacy and comments.

Rhizoctonia Limb Rot:
Rhizoctonia Limb Rot is caused by naturally-occurring soil fungi, *Rhizoctonia* spp. (*R. solani*), that can cause lesions and rot on limbs/stems, leaves, pegs and pods. Lesions on stems are light to dark brown and often have a target pattern. Dense canopies and prolonged moisture (irrigation) encourages disease development. Tractor traffic damage increases occurrence of limb rot. Management recommendations are similar as for white mold (see Disease Response Chart for fungicide activity).

Web Blotch:
Web blotch, caused by *Phoma arachadichola*, produces lesions on upper leaf surfaces. Symptoms start as small, tan to dark brown blotches with irregular edges or netlike gray-brown lesions that can become large (0.5") and cover entire leaves. Older lesions darken and have rough, dull surfaces. Severe infections cause leaves to become brittle, which can lead to substantial defoliation. Web blotch development favors cool, moist conditions and is more common under irrigation. Many of the fungicides effective against late leaf spot share activity towards web blotch (see Disease Response Chart for fungicide activity).

General Guidelines for Fungicide Programs:

- Begin leaf spot control **absolutely no later than 45 DAP**. For high risk situations such as highly susceptible varieties (e.g., Gregory, Champs, Georgia 13M, TUFRunner 511), or short rotations, particularly under irrigation, increase late leaf spot protection using one of the options listed in footnotes of the following tables.

- **Apply a soil fungicide (see following disease control table) starting absolutely no later than 60 DAP.** White mold must be prevented, and hot weather accelerates white mold growth.

- If premium fungicides (e.g., Elatus, Priaxor, Provost Opti) are substituted for basic tebuconazole + chlorothalonil treatment, prioritize their use starting at 60 DAP rather than later to get the most potential for improved white mold and/or leaf spot control.

- Soil fungicides must be washed into the soil to be effective against white mold, but **wait 24 – 48 h before irrigating** to also help control leaf spot.

- **Except for treatments containing chlorothalonil (Bravo), do not make consecutive applications of the same mode of action (MOA).** Bravo has multiple modes of action which has allowed for many years of use without leaf spot resistance. In each field, do not apply more than a combined total of 2 strobilurin-containing products (Abound, Elatus, Evito, Headline, Priaxor or Stratego) in any growing season to reduce risk of resistance.

- **Never apply Topsin or tebuconazole alone, and do not make more than 2 tank-mixed Topsin applications per season.** Topsin is very susceptible to development of resistance. Late leaf spot is already resistant to tebuconazole.

- **No fungicide program is fool-proof.** Spot check fields for leaf spot and white mold, particularly from 60 DAP to two weeks before anticipated digging date.

- A final leaf spot application at 105 DAP is usually adequate to provide control through at least a 135 DAP harvest date, but check fields at 120 DAP. If leaf spot is present on 5% of lower leaves and harvest will be delayed > 135 DAP, apply an additional chlorothalonil treatment. If no leaf spot is present and harvest will be delayed > 145 DAP, apply an insurance treatment.

Preventative Calendar Spray Programs:
The key to peanut disease control is preventing diseases from getting started. This is true for both soil and foliar diseases. Alternating or tank mixing different fungicide chemistries reduces the potential for developing resistant strains of leaf spot diseases. Alternating or tank mixing fungicides also provides some insurance against the failure of one product alone.

Note: The disease control programs on the following pages are guidelines. Timing (DAP = days after planting) should be modified to account for opportunities to wash soil fungicides into the pegging zone if no irrigation is available. Under drought conditions, growers have to rely on judgment of the 5-day weather forecast to decide when to apply a soil fungicide before a rain.

Ideally, fungicide treatments would be washed into the soil after 1 – 2 days to get both maximum foliar and soil disease suppression.

DISEASE CONTROL PROGRAM OPTIONS

If premium fungicides are substituted for basic tebuconazole + chlorothalonil (generic Folicur + Bravo), prioritize their use starting 60 DAP rather than later to maximize potential benefits.

<table>
<tr><td colspan="7">Treatment options and timing (days after planting)</td></tr>
<tr><td>30</td><td>45*</td><td>60*</td><td>75</td><td>90</td><td>105</td><td>120</td></tr>
<tr><td rowspan="8">Optional Bravo (1-1.5 pt) (+ Cadre) for high leaf spot risk</td><td>Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td rowspan="8">Bravo for late maturing peanuts**</td></tr>
<tr><td rowspan="7">tebuconazole 7.2 fl oz + Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>Bravo 1.5 pt</td></tr>
<tr><td>Substitute, see below</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td rowspan="2">tebuconazole 7.2 fl oz + Bravo 1.5 pt</td><td rowspan="4">tebuconazole 7.2 fl oz + Bravo 1.5 pt</td></tr>
<tr><td>Substitute, see below</td><td>Substitute, see below</td></tr>
<tr><td>Substitute, see below</td><td>tebuconazole 7.2 + Bravo 1.5 pt</td><td>Substitute, see below</td></tr>
<tr><td>Substitute, see below</td><td>Substitute, see below</td><td>Substitute, see below</td></tr>
<tr><td>Substitute, see below</td><td>Substitute, see below</td><td>Substitute, see below</td><td>Substitute, see below</td></tr>
</table>

*Under high leaf spot risk (e.g., very susceptible variety, irrigated or with frequent rain-off and leaf wetting, or late planting) use a premium fungicide with strong leaf spot activity at 60 DAP; use of additional premium products can improve management. Spray intervals can be reduced to 10 days for improved leaf spot control under frequent rain-off conditions. **Make sure leaf spot prevention begins no later than 45 DAP and soil fungicide is applied no later than 60 DAP.** White mold must be prevented; hot weather and a closed canopy in Jul – Aug accelerates white mold growth. Do not use surfactants or crop oil with fungicides unless necessary for herbicide performance in tank mixes. The goal is to wash white mold fungicides into the soil. Spray **before** irrigation or rain when possible.

**An extra late season Bravo application may be needed for late maturing peanuts. If it has been 15 days since the last application and peanuts will be dug within the next 25 days, do not treat unless > 5% of leaflets in the bottom of the canopy have late leaf spot lesions. Never spray fungicide within 2 weeks of harvest – it is off-label and is too late to affect defoliation.

Note: Use of chlorothalonil in the last spray (105 or 120 DAP) can help prevent resistant leaf spot strains that may have developed from overwintering and causing infection in the following year.

The treatments in the following tables can be substituted for tebuconazole + Bravo from 60 DAP to 105 DAP. Except for treatments containing Bravo (chlorothalonil), consecutive use of the same mode of action (MOA) group is not recommended in order to delay leaf spot resistance. Bravo has multiple modes of action and there has been no evidence of resistance in 40+ years of use.

MOA = Fungicide Resistance Action Committee (FRAC) Mode of Action Group. Having the same mode(s) of action does not mean treatments are equally effective.

Generic chlorothalonil, Tilt + Bravo, Topsin + Bravo, or other alternatives (see Disease Control table) can be substituted for Bravo. Avoid consecutive use of the same MOA if Bravo is not tank mixed.

PEANUT DISEASE CONTROL

FOLIAR DISEASE CONTROL ONLY (Early and late leaf spot, pepper spot, web blotch, rust)			
Product	**Rate/A**	**MOA***	**Comments**
Bravo Weather Stik 6SC (and chlorothalonil generics)	1.5 pt	M5	Chlorothalonil products are preventative only against leafspot and require excellent coverage. **Rust** infection is rather rare in SC peanut production, but if rust is detected with more than 3 weeks to harvest, include chlorothalonil every 10 days until 2 weeks before harvest.
Bravo + Topsin 4.5 FL or Topsin M 70W	1 pt + 8-10 fl oz 0.33-0.5 lb	M5 + 1	Topsin should only be used in Bravo tank mixes. Maximum 2 appl. per season.
Alto 100 SL + Abound 2.08 F	5.5 fl oz + 18 fl oz	3 + 11	Systemic triazole and strobilurin activity.
Elatus 0.45 WG	7.3-9.5 fl oz	7 + 11	Excellent leaf spot activity. Systemic.
Provost Opti 3.6	7-8 fl oz	3	Highly effective against soil and foliar diseases.
Priaxor 4.17	4-6 fl oz	7 + 11	Systemic activity against leaf spot.
Bravo + Topguard	1 pt + 7-14 fl oz	M5 + 3	Topguard adds systemic leaf spot control to Bravo.
Absolute 500 SC	3.5 fl oz	3 + 11	Systemic triazole and strobilurin activity.
Headline 2.08	6-9 fl oz	11	Highly systemic and rain-fast. We may be seeing the reduced Headline (strobilurin) effectiveness against leaf spot due to strobilurin use patterns.
Custodia 2.67 SC	15.5 fl oz	3 + 11	Add 1 pt/A Bravo for late leaf spot use. Max 2 appl.
Muscle ADV 3.84	2 pt	3 + M5	Add 0.5 pt/A Bravo for late leaf spot use.
Elast 400F	15 fl oz	U12	Elast not recommended on varieties highly susceptible to leaf spot.
Stratego†	10-14 fl oz	3 + 11	Systemic triazole and strobilurin activity.
Tilt Bravo SE 4.3† (jug mix)	1.5 pt	3 + M5	Tilt adds some systemic leaf spot control to Bravo. Tilt mixes not recommended for rust.

FOLIAR AND SOIL DISEASE CONTROL (Other than CBR)			
Product	**Rate/A**	**MOA***	**Comments**
Tebuconazole (generic Folicur 3.6) + Bravo	7.2 fl oz + 1.5 pt	3 + M5	Tebuconazole alone no longer controls leaf spot or web blotch. Must be tank mixed with Bravo.
Convoy 40SC + Bravo	13-16 fl oz +1.5 pt	7 + M5	Must be tank mixed with Bravo for adequate leaf spot control. Excellent white mold suppression.
Quash 50 WDG + Bravo	4 oz + 1 pt	3 + M5	Must tank mix with Bravo to manage leaf spot.
Provost Opti 3.6	10.7 fl oz	3	Highly effective against soil and foliar diseases.
Elatus 0.45 WG	7.3-9.5 fl oz	7 + 11	Excellent white mold and leaf spot activity.
Priaxor 4.17	8 fl oz	7 + 11	Systemic activity against white mold and leaf spot.
Fontelis 1.67	16 fl oz	7	Systemic activity against white mold and leaf spot.
Alto 100 SL + Abound 2.08 F	5.5 fl oz + 18 fl oz	3 + 11	Erratic against white mold. Systemic for leaf spot.
Propulse 3.34	13.6 fl oz	3 + 7	Systemic activity against soil and foliar disease.
Evito 480SC	5.7 fl oz	11	Strobilurins are more erratic against white mold.
Custodia 2.67 SC	15.5 fl oz	3 + 11	Add 1 pt/A Bravo for late leaf spot use. Max 2 appl.
Muscle ADV 3.84	2 pt	3 + M5	Add 0.5 pt/A Bravo for late leaf spot use.
Headline 2.08	12-15 fl oz	11	Highly systemic and rain-fast. We may be seeing reduced Headline (strobilurin) effectiveness against leaf spot due to use patterns of strobilurins. Headline erratic on white mold due to rapid uptake on leaves.
Artisan† + Bravo	16-20 fl oz + 1.5 pt	7 + M5	Must be tank mixed with Bravo for adequate leaf spot control. Excellent white mold suppression.

†Check with your buying point: peanuts treated with propiconazole may not be accepted for international export (European Union).

***Except for treatments containing Bravo (chlorothalonil), consecutive use of the same mode of action (MOA) group is not recommended in order to delay leaf spot resistance.**

PEANUT DISEASE CONTROL (cont.)

Early Season Banded Treatment Options for Improved White Mold and Leaf Spot Management			
Product	**Rate/A**	**MOA**	**Comments**
Elatus 0.45 WG	8.9 oz (38" rows)	7 + 11	Recommended as early season (approximately 21 DAP) banded application for high risk white mold fields. Also provides early season leaf spot control. Apply in a minimum of 10 gal/A. Set band width at 7 – 10" for single rows (twin-rows: widen band to cover both rows). **Banded rates** are 0.5 – 0.65 oz/1,000 row ft, which is equivalent to 8.7 – 9.5 oz/A on 30" rows, 7.3 – 9.4 oz/A on 36" rows, and 6.9 – 8.9 oz/A on 38" rows. Do not exceed 9.5 oz/A.
Proline 480 SC	5.5 fl oz (38" rows) 5.7 fl oz (30", 36" rows)	3	Recommended as early season (21-35 DAP), high volume (20 gal/A) banded application (up to 12" band) for high risk white mold fields. Also provides extended (21 day) early season leaf spot control. Banded rate is 0.4 fl oz/1,000 row ft (maximum 5.7 fl oz/A), which is equivalent to 5.7 fl oz/A on 30" or 36" rows and 5.5 fl oz/A on 38" rows. **Proline must be used in-furrow for CBR suppression** (see below) **and over the top for white mold control.**

CBR CONTROL			
Product	**Rate/A**	**MOA**	**Comments**
Proline 480 SC (in-furrow, suppression)	5.5 fl oz (38" rows) 5.7 fl oz (30", 36" rows)	3	**Resistance**: Bailey variety is more effective than any chemical treatment in reducing CBR loss and often provides adequate control without fumigation or in-furrow fungicide treatment. **Crop rotation** is extremely important in reducing CBR risk. Delaying planting until mid-May can suppress CBR by increasing soil temp. **Proline** is applied in-furrow with inoculant. In-furrow rate is 0.4 fl oz/1,000 row ft (maximum 5.7 fl oz/A), equivalent to 5.7 fl oz/A on 30" or 36" rows and 5.5 fl oz/A on 38" rows.
Propulse 3.34 (in-furrow, suppression)	13.6 fl oz	3 + 7	**Resistance**: Bailey variety is more effective than any chemical treatment in reducing CBR loss and often provides adequate control without fumigation or in-furrow fungicide treatment. **Crop rotation** is extremely important in reducing CBR risk. Delaying planting until mid-May can suppress CBR by increasing soil temp. **Propulse** is applied in-furrow with inoculant.
Vapam HL (metam sodium 42%)	10 gal	NC	Resistance: Bailey variety is more effective than any chemical treatment in reducing CBR loss and often provides adequate control without fumigation or in-furrow fungicide treatment. **Vapam** must be shanked into the soil (8" depth) and bedded at least 14 days prior to planting. Soil temperature at 4" depth should be 60°F. Do not fumigate when rain (1.0" or more) is expected within 48 hrs.

GUIDE TO PEANUT FUNGICIDES

Product	Chemistry	MOA*	Risk of leaf spot resistance	Feed hay	PHI (days)	Strengths	Limitations
Abound	Strobilurin (azoxystrobin)	11	High	Y	14	Has white mold activity and may be the best Rhizoctonia material. Systemic leaf spot and web blotch activity.	Erratic against established white mold infections 75 – 90 DAP. Mix with Alto to improve leaf spot activity.
Absolute	Triazole (tebuconazole) + Strobilurin (trifloxystrobin)	3 + 11	Already resistant + high	N	14	Systematic leaf spot activity.	Less effective against white mold.
Alto	Triazole (cyproconazole)	3	High	Y	30	Systematic leaf spot activity.	Minimal if any soil disease control.
Artisan	Benzamide (flutolanil) + Triazole (propiconazole)	7 + 3	High	N	40	Excellent against white mold and limb rot, has activity against early leaf spot.	Will not control late leaf spot, must tank-mix with chlorothalonil. No CBR suppression.
Bravo/ generics	Chloronitrile (chlorothalonil)	M5	Low	N	14	Low cost, reliable leaf spot control. Multiple modes of action reduce risk of leaf spot resistance. Can make multiple consecutive appl.	No soil disease activity. Not curative or systemic. Less effective than many systemics on web blotch. Preventative activity only against leaf spot.
Convoy (or Moncut)	Benzamide (flutolanil)	7	Low	N	40	Excellent white mold and Rhizoctonia activity.	No activity against foliar diseases or CBR. Must tank-mix with chlorothalonil.
Custodia	Triazole (tebuconazole) + Strobilurin (azoxystrobin)	3 + 11	Already resistant + high	N	14	Activity against foliar and soil diseases.	Needs Bravo tank-mix for adequate leaf spot control. Max 2 appl. recommended.
Elast	Guanidine (dodine)	U12	Low to medium	Y	14	Leaf spot alternative to Bravo.	Less effective than Bravo for leaf spot on highly susceptible varieties. No soil efficacy.
Elatus	Carboxamide (benzovindiflupyr) + Strobilurin (azoxystrobin)	7 + 11	Medium to high	Y	30	Excellent late leaf spot activity. Alternative chemistry for both leaf spot and soil disease.	Should be alternated with MOA alternative to strobilurin and carboxamide.
Endura	Carboxamide (boscalid)	7	Medium to high	N	14	Activity against Sclerotinia blight (not common in SC). Good leaf spot activity.	Inadequate against white mold.
Evito	Strobilurin (fluoxastrobin)	11	High	Y	14	Performance of 5.7 oz similar to 18 oz Abound.	Performance of 5.7 oz similar to 18 oz Abound.
Folicur/ generics	Triazole (tebuconazole)	3	Already resistant	N	14	Very cost-effective control of white mold and limb rot.	Not effective against web blotch. No longer effective against late leaf spot; must tank-mix with Bravo.

***MOA = Mode of action group. Treatments without Bravo (chlorothalonil) that share the same MOA should not be used consecutively to delay leaf spot resistance.** There is no single perfect fungicide. The best programs combine several products that complement each other to minimize disease and resistance risk at reasonable cost.

GUIDE TO PEANUT FUNGICIDES (Cont.)

Product	Chemistry	MOA*	Risk of leaf spot resistance	Feed hay	PHI (days)	Strengths	Limitations
Fontelis	Carboxamide (penthiopyrad)	7	Medium to high	Y	14	Excellent white mold activity and effective against leaf spot.	Rotate with alternative chemistry to reduce leaf spot resistance risk.
Headline	Strobilurin (pyraclostrobin)	11	High	N	14	Systemic leaf spot activity at 6-9 oz, some white mold activity at 12-15 oz rates. Rapid uptake for systemic activity in leaves.	White mold activity erratic. Leaf spot activity of Headline (and other strobilurins) may have declined. Do not exceed 2 strobilurin appl. per season.
Lorsban 15G	Organophosphate (chlorpyrifos)	?	Low	N	21	White mold suppression. Preventative control of soil insects.	Causes worm and spider mite outbreaks. Requires granular band appl. Increases Rhizoctonia limb rot.
Muscle ADV	Triazole (tebuconazole) + Chloronitrile (chlorothalonil)	3 + M5	Already resistant + low	N	14	Activity against foliar and soil diseases.	Needs Bravo tank-mix for adequate leaf spot control.
Priaxor	Carboxamide (fluxapyroxad) + Strobilurin (pyraclostrobin)	7 + 11	Medium to high	N	14	White mold and leaf spot activity at 8 oz. Has demonstrated excellent late leaf spot control.	Maximum of two appl. per season recommended.
Proline	Triazole (prothioconazole)	3	Medium	N	14	Excellent leaf spot and white mold activity in early season band. CBR suppression in-furrow.	Rotate with alternative chemistry to reduce leaf spot resistance risk.
Propulse	Triazole (prothioconazole) + Carboxamide (fluopyram)	3 + 7	Medium to high	N	14	Excellent leaf spot and white mold activity. CBR suppression in-furrow.	Rotate with alternative chemistry to reduce leaf spot resistance risk.
Provost Opti	Triazole (prothioconazole + tebuconazole)	3	High	N	14	High level of control for major foliar (leaf spot) and soil (white mold, Rhizoctonia) diseases. Reformulated for improved tank-mixing compatibility.	Triazoles vulnerable to leaf spot resistance. Must be rotated or tank-mixed with other chemistry.
Quash	Triazole (metconazole)	3	Medium	N	14	Effective against white mold.	Needs Bravo tank-mix for leaf spot control.
Stratego	Triazole (propiconazole) + Strobilurin (trifloxystrobin)	3 + 11	Medium	Y	14	Combination of Tilt and Flint – has good systemic activity against leaf spot.	Little or no white mold activity.

***MOA = Mode of action group. Treatments without Bravo (chlorothalonil) that share the same MOA group should not be used consecutively to delay leaf spot resistance.** There is no single perfect all-around fungicide. The best programs combine several products that complement each other to minimize disease and resistance risk at reasonable cost.

GUIDE TO PEANUT FUNGICIDES (Cont.)

Product	Chemistry	MOA*	Risk of leaf spot resistanc	Feed hay	PHI	Strengths	Limitations
Tilt Bravo SE	Triazole (propiconazole) + Chloronitrile (chlorothalonil)	3 + M5	Low	N	14	Tilt adds systemic leaf spot control to Bravo's contact protection.	Tilt has very weak activity against soil diseases and Bravo has none. Tilt alone will not control late leaf spot.
Topguard	Triazole (flutriafol)	3	Medium	N	7	Systemic leaf spot control, active against white mold.	Triazoles vulnerable to leaf spot resistance. Must be rotated or tank-mixed with other MOA.
Topsin 4.5FL	Benzimidazole (thiophanate-methyl)	1	Very high	Y	14	Topsin adds systemic activity to Bravo. Cost effective, high risk treatment for leaf spot.	Topsin alone very susceptible to resistance. Must be tank-mixed and limited to two applications per year. Little or no soil activity.
Velum Total	Carboxamide (fluopyram)	7	Medium to high	N	14	Provides in-furrow control of thrips and nematodes.	Less effective early season leaf spot control than banded appl. of Proline or Elatus. Imidacloprid component often increases TSWV severity.

***MOA = Mode of action group. Treatments without Bravo (chlorothalonil) that share the same MOA group should not be used consecutively to delay leaf spot resistance.** There is no single perfect all-around fungicide. The best programs combine several products that complement each other to minimize disease and resistance risk at reasonable cost.

Disease Response Chart for Peanut Fungicides

Product	Rate/A	Late leaf spot	White mold	Rhizoctonia limb rot	Cylindrocladium black rot (CBR)	Web blotch
Abound + Alto	18 oz + 5.5 oz	V. Good	Good	Ex.	Poor	Good
Absolute	3.5-7 oz	Good/V. Good	Poor	Good? (7 oz)	None	Good?
Alto	5.5 oz	Good/V. Good	Fair/Poor	Fair/Poor?	Poor	Good
Artisan[1,2] + Bravo	16-20 oz + 1 pt	V. Good	Ex.	V. Good	None	Fair/Good
Bravo (or generics)	1.5 pt	V. Good	None	None	None	Fair
Convoy[1] + Bravo	13-26 oz + 1.5 pt	V. Good	Ex.	V. Good	None	Fair
Evito	5.7 oz	Good/V. Good	Good	?	Poor	Good?
Elast[3]	15 oz	Fair	None	None	None	None
Elatus	7.3-9.5 oz	Ex.	V. Good/Ex.	V. Good/Ex.?	Poor	Good
Endura	8-10 oz	Good	Fair	?	Poor	Good
Fontelis	16 oz	V. Good	Ex.	V. Good/Ex.?	Poor	?
tebuconazole + Bravo	7.2 oz + 1-1.5 pt	V. Good	V. Good	V. Good	Poor/Fair	Good?
Headline	6-12 oz	Good/V. Good	Fair (12-15 oz)	Good/V. Good?	Poor	Ex.
Moncut + Bravo	0.5 lb + 1.5 pt	V. Good	Ex.	V. Good	None	Fair
Priaxor	4-8 oz	Ex. (6-8 oz) V. Good (4 oz)	V. Good/Ex. (6-8 oz)	V. Good/Ex.? (8 oz)	Poor	Good?
Proline	5.7 oz	Ex.	Ex.	V. Good	Good (in-furrow)	Good?
Propulse	13.6 oz	Ex.	Ex.	V. Good	V. Good/Ex. (in-furrow)	Good?
Provost Opti	8-10.7 oz	V. Good/Ex.	V. Good (8 oz) Ex. (10.7 oz)	V. Good	Poor/Fair	Good?
Quash + Bravo	3-4 oz + 1 pt	V. Good	V. Good	?	Poor?	Good?
Stratego[2]	10-14 oz	V. Good	Poor	Good (14 oz)	None	Good?
Tilt Bravo SE (or generics)[2]	1.5 pt	V. Good	Poor	Poor	None	Fair
Topguard	7-14 oz	Good/V. Good	Good	?	None	Good?
Topsin 4.5FL[4] + Bravo	8-10 oz + 1.5 pt	V. Good/Ex.[4]	None	Fair?	None	Fair?

***Ratings are based on the relative performance of the listed application rates. Effective disease control and resistance prevention requires multiple application programs with a combination of materials. None** = no control; **Poor** = low level of control; **Fair** = erratic control or suppression only; **Good** = controls typical disease pressure; **V. Good** = very good: better than average disease control; **Ex.** = excellent: consistent superior control.

[1]**Artisan or Convoy** can be applied up to 32 oz/A for maximum white mold control, but both must be tank-mixed with Bravo or alternative for leaf spot control.
[2]Check with your buying point: peanuts treated with **propiconazole** may not be accepted for international export (European Union).
[3]**Elast** is not recommended for highly susceptible Virginia-type varieties.
[4]**Topsin** is highly effective against leaf spot as a tank-mix with Bravo. Never use Topsin alone, and never exceed 2 total Topsin applications per season.

PEANUT NEMATODE CONTROL

Dan Anco, Extension Peanut Specialist
John D. Mueller, Extension Plant Pathologist

Fortunately, nematodes have been a relatively minor problem on peanuts in South Carolina. Peanut root-knot (race 1) nematode is capable of causing severe losses, but economic injury has been very rare. Lesion nematode frequently causes hull injury on green peanuts and can cause yield reduction under extremely high populations. Sting nematode is rarely found in peanut fields in South Carolina, but when observed damage can be severe even at relatively low populations. Hull injury from nematode infection can also lead to increased fungal colonization and disease of pods.

Nematode management is not recommended for peanuts in South Carolina unless injury or damage to peanuts has been documented. Crop rotation and resistance are the most economical and desired management strategies for minimizing nematode problems. A nematode resistant variety (Georgia 14N, Tifguard, TifNV-High O/L) is recommended for fields with a documented history of peanut root-knot nematode injury on peanut. A fumigant like Telone II (field-wide: 6 – 9 gal/A, in-row: 4.5 – 6 gal/A) or Vapam HL (6.61 fl oz/100 linear row ft) applied 2 weeks at a depth of 12" prior to planting can be used to suppress nematodes. Alternatively, Velum Total (18 fl oz/A) can be applied in-furrow or through root-zone chemigation to manage nematodes near the taproot. Propulse (13.6 fl oz/A) can be applied at pegging (~45 DAP) to manage nematodes in the fruiting zone but must be watering in to be effective (0.10 – 0.25 in/A water). AgLogic 15G (aldicarb) (7 lb/A at-planting, with an optional pegging application at 10 lb/A) has recently been approved for use in nematode management, though current supply may be limited.

Peanuts are an excellent rotation crop to suppress Reniform, Southern Root-knot and Columbia lance nematodes in cotton.

Field Crop Hosts for Common Nematodes

	Root-knot									
Crop	Southern	Peanut race 1	Peanut race 2	Northern	Lesion	Lance	Soybean cyst	Sting	Ring	Reniform
Peanut	-	+	-	+	+	-	-	±	+	-
Cotton	+	-	-	-	+	+	-	+	+	+
Corn	+	+	+	+	+	+	-	+	±	-
Soybean	+	+	+	+	+	+	+	+	±	+
Tobacco	+	+	+	+	+	-	-	-	+	+
Small grain	+	+	+	+ - (wheat)	+	+	-	+	+	-
Grain sorghum	+	+	+	?	+	?	-	+	-	-
Tomato	+	+	+	+	+	-	-	+	+	?

+ indicates host; - indicates non-host; ± indicates host reaction can vary based on population. Adapted by J. D. Mueller from: Powell, W. M. 1990. Plant susceptibility to major nematodes in Georgia. Univ. of Georgia Extension Bulletin 904; and Dickerson, O. J., J. H. Blake, and S. A. Lewis. 2000. Nematode guidelines for South Carolina. Clemson Univ. Extension Circular 703.

WEED CONTROL IN SMALL GRAINS

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gramoxone SL (*paraquat*)	2.0-4.0 pt	0.5-1.0 lb	22	60 days	12 hours
Firestorm 3 S Parazone 3 S	1.5-2.0 pt				
Comments: *Labeled for use in barley and wheat only*. GRAMOXONE is a RESTRICTED USE PESTICIDE. Add non-ionic surfactant at 1 pt per 100 gal of spray solution or crop oil concentrate at 1 gal per 100 gal of spray solution. Rate dependent on weed size.					
Glyphosate acid equivalent (ae)				7 days	4 hours
5.5 SL (4.5 lb ae)	11-32 fl oz	0.38-1.13 lb ae	9		
Comments: *Labeled for for use in oats, wheat, barley, and rye*. Apply 2 to 4 weeks before planting date to control existing summer annual grass and broadleaf weeds and reduce competition with small grain seedlings.					
Glyphosate (several brands)	see glyphosate	0.38-1.13 lb ae	9	45 days	4 hours
+					
Harmony Extra SG (*thifensulfuron*	0.45-0.9 oz	0.0094-0.0188	2		
+		+			
tribenuron)		0.0047-0.0094	2		
Comments: *Harmony Extra SG labeled for use in wheat and barley only*. GLYPHOSATE + HARMONY EXTRA SG may be used as a burndown treatment prior to, or shortly after planting (but before crop emergence). Consult glyphosate product to determine if an adjuvant is needed. If an adjuvant is needed, then add NIS (80% active or greater) at 1 qt/100 gallons of spray solution plus urea ammonium nitrate (28-32% N) or ammonium sulfate (AMS) at 2 lb/A.					
Sharpen 2.85 SC (*saflufenacil*)	1.0-2.0 fl oz	0.022-0.045 lb	14	30 days	12 hours
Comments: *SHARPEN is labeled for use in wheat, oats, barley, rye, and triticale*. Apply SHARPEN for early burndown and/or limited residual control of broadleaf weeds. For optimum burndown activity, add methylated seed oil (MSO) at 1 gal per 100 gal plus ammonium sulfate (AMS) at 8.5 to 17 lbs per 100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals per 100 gals of spray volume. Do not apply more than 4.0 fl oz/A of SHARPEN per cropping season.					
Valor SX 51WDG (*flumixoazin*)	2.0 oz	0.064 lb	14	--	12 hours
Valor EZ 4SC	2.0 fl oz				
Comments: *VALOR SX is labeled for use in wheat only*. For preplant weed control use only in no-till or minimum tillage fields where previous year's crop residue has not been incorporated into the soil. Plant wheat no sooner than 7 days after VALOR SX application. Do not irrigate between emergence and spike growth stage. Wheat must be planted a minimum of 1 inch deep. Do not graze until wheat has reached 5 inches in height. Do not apply more than 2.0 oz/A of VALOR SX during a single growing season.					

Weed Response to Herbicides for Small Grain Weed Management[1]

	PRE	POSTEMERGENCE																			
	Sharpen	Achieve	Anthem FLEX	Axial XL	Axiom	Banvel/Clarity	Beyond[2]	Buctril	Express	Fierce	Finesse	Harmony Extra	Huskie	MCPA	Osprey	Peak	PowerFlex HL	Sentrallas	Valor SX	WideMatch	Zidua	2,4-D
barley, little	P	P	G	P	G	P	G	P	P	---	---	P	P	P	---	P	---	P	---	P	---	P
bluegrass, annual	P	P	G	P	G	P	G	P	P	---	P	P	P	P	GE	P	P	P	---	P	---	P
buttercup	---	P	---	P	---	F	P	F	E	---	G	GE	G	---	---	G	---	---	---	G	---	G
cheat	P	P	F	P	E	P	G	P	P	---	---	P	P	P	P	P	FG	P	---	P	---	P
chickweed, common	F	P	GE	P	G	G	F	F	G	GE	G	G	GE	P	FG	G	FG	GE	GE	G	GE	P
cornflower	---	P	---	P	---	FG	---	GE	---	---	F	P	---	---	P	G	P	G	---	G	---	G
cudweed	---	P	---	P	G	GE	G	PF	---	---	---	E	GE	GE	---	---	---	---	---	GE	---	GE
dock, curly	---	P	---	P	P	F	P	PF	E	FG	---	E	G	P	P	---	P	G	F	F	---	P
eveningprimrose, cutleaf	---	P	G	P	GE	G	---	P	F	FG	---	G	GE	E	P	G	P	F	FG	G	G	E
garlic, wild	---	P	---	P	P	F	P	F	P	P	P	E	P	P	P	GE	P	P	---	P	---	F
geranium, Carolina	---	P	---	P	F	G	G	G	G	---	GE	G	---	G	---	---	---	G	---	G	---	F
henbit	F	P	GE	P	GE	F	G	F	G	GE	G	G	GE	P	G	GE	FG	F	GE	G	GE	P
horseweed	G	P	GE	P	---	GE	---	G	F	GE	---	F	GE	F	P	---	P	F	GE	G	GE	G
knawel	---	P	---	P	---	G	---	P	---	---	---	G	---	---	---	---	---	GE	---	---	---	P
mustard, wild	G	P	GE	P	G	F	F	G	E	GE	G	E	GE	GE	G	GE	GE	G	G	F	GE	GE
pepperweed, Virginia	---	P	G	P	---	F	---	FG	---	GE	---	G	GE	---	---	---	---	---	G	---	G	E
pennycress, field	---	P	---	P	---	F	---	G	---	---	G	G	GE	---	---	G	---	---	---	F	---	G
radish, wild	---	P	GE	P	G	F	F	G	E	GE	G	E	GE	GE	G	GE	GE	F	G	F	GE	GE
ryegrass, Italian	P	GE	E	E	G	P	G	P	P	E	F	P	P	P	E	P	E	P	E	P	E	P
ACCase-resistant	P	P	E	P	G	P	G	P	P	E	F	P	P	P	E	P	E	P	E	P	E	P
ALS-resistant	P	GE	E	E	G	P	G	P	P	E	P	P	P	P	P	P	P	P	E	P	E	P
shepherdspurse	---	P	GE	P	---	FG	---	G	---	GE	G	E	GE	GE	---	GE	---	G	G	P	GE	GE
swinecress	---	P	---	P	G	---	---	GE	---	---	---	E	GE	G	E	---	---	G	---	---	---	G
thistles	---	P	---	P	G	GE	G	G	---	---	GE	FG	E	G	---	GE	---	---	---	G	---	G
vetch	---	P	---	P	G	E	P	G	G	---	GE	P	E	---	PF	---	P	---	---	---	---	G

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = less than 70% control; --- = Insufficient Data.
[2]Use only on Clearfield wheat varieties.

Preemergence Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Sharpen 2.85 SC (*saflufenacil*)	1.0-2.0 fl oz	0.022-0.045 lb	14	30 days	12 hours

Comments: *SHARPEN is labeled for use in wheat, oats, barley, rye, and triticale*. Apply SHARPEN right after planting small grains for controlling emerged broadleaf weeds and/or limited residual control of broadleaf weeds. For optimum activity of emerged weeds, add methylated seed oil (MSO) at 1 gal per 100 gal plus ammonium sulfate (AMS) at 8.5 to 17 lbs per 100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals per 100 gals of spray volume. Do not apply more than 4.0 fl oz/A of SHARPEN per cropping season. Do not apply after small grain emergence or crop injury will occur.

Early Postemergence Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Anthem FLEX 4SE	2.0-2.7 fl oz			7 days	12 hours
(*pyroxasulfone*		0.058-0.082 lb	15		
+		+			
carfentrazone)		0.004-0.006 lb	14		
Comments: Labeled for wheat only. Apply ANTHEM FLEX from spiking up to 4th tiller growth stage. Wheat must be planted at least 1 inch deep. Under high moisture conditions, crop may experience temporary injury response, but will rapidly outgrow these effects and develop normally with no reduction in yield. Controls little barley, annual bluegrass, rattail fescue, and annual ryegrass. Do not apply to durum wheat. Do not apply preplant incorporated in wheat. Do not apply preplant, preemergence, or early postemergence to broadcast seeded wheat.					
Axiom 68 WDG	4.0-8.0 oz			30 days	12 hours
(*flufenacet*		0.14-0.27 lb	15		
+		+			
metribuzin)		0.03-0.07 lb	5		
Comments: *Labeled for wheat only*. AXIOM contains metribuzin, which may injure certain wheat varieties, consult label for details. Apply AXIOM from spike to 2-leaf growth stage. Wheat must be planted at a depth of 1.0-2.0 in deep or injury may occur. Controls henbit, wild radish, and annual bluegrass. Activity on annual ryegrass is good (up to 1 leaf growth stage), depending on timely rainfall after application. For sequential applications, do not apply more than 8 oz/A of AXIOM per growing season.					
Fierce 76 DF	1.5 oz			---	12 hours
(*flumioxazin*		0.040 lb	14		
+		+			
pyroxysulfone)		0.031 lb	15		
Comments: *Labeled for wheat only*. Apply FIERCE when 95% of wheat is in the spike to 2-leaf growth stage. Controls emerged ryegrass up to 0.5 in in height. Wheat must be planted a minimum of 1.0 in deep or injury may occur. Do not apply to fields where wheat seed has been broadcast and shallow incorporated. Do not tank mix FIERCE with any adjuvant, fertilizer, or other pesticide or severe wheat injury will occur. Apply FIERCE in 10 to 15 gallons per acre of water to ensure adequate coverage of emerged ryegrass. Do not apply more than 1.5 oz/A of FIERCE per growing season.					
Zidua 85 WG	1.0-2.5 oz			7 days	12 hours
(*pyroxysulfone*)		0.053-0.133 lb	15		
Comments: *Labeled for wheat only*. Apply ZIDUA when wheat is in the early spike (at least 0.5 in shoot) to 4th tiller growth stage. Do not apply ZIDUA early preemergence (0.5 in shoot to full spike stage) to broadcast seeded wheat fields. Do not irrigate after a ZIDUA application during the early spike growth stage until wheat is at the full spike stage. Do not plant wheat deeper than 1.5 inches before an early preemergence application of ZIDUA. Do not apply ZIDUA to flood prone fields or fully saturated soils. Do not apply more than 2.5 oz/A of ZIDUA per growing season.					

Postemergence Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Achieve 40DG (*tralkoxydim*)	6.9-9.2 oz	0.18-0.25 lb	1	60 days	12 hours

Comments: *Labeled for wheat and barley only*. Apply to the crop from 1-leaf to flag leaf growth stage. Always add Supercharge adjuvant at 2 qt/100 gallons of spray solution. For best activity on Italian ryegrass, apply when ryegrass is small (1-4 leaf growth stage). Tank mix partners include 2,4-D, BUCTRIL, MCPA, STARANE, WARRIOR and STINGER. Herbicides not specified for tank mixing may be applied separately in sequence (minimum of 7 days after ACHIEVE application). Apply in at least 10 gallons of water carrier per acre. ACHIEVE may be tank mixed in a spray solution with liquid nitrogen fertilizers (maximum of 5 gallons of N per acre in a 1:1 ratio of water). **Rainfast interval = 1 hour.**

Resistance Management: *ACCase-resistant (MOA=1) Italian ryegrass has been documented in South Carolina. Continued reliance on ACCase-inhibiting products, such as ACHIEVE and AXIAL, will enhance selection and spread of resistant biotypes. Therefore, consider adding AXIOM, FIERCE, ZIDUA, or PROWL H2O to your herbicide program for resistance management.*

Axial XL 0.42 SL (*pinoxaden*)	16.4 fl oz	0.054 lb	1	60 days	48 hours

Comments: *Labeled for wheat and barley only.* Apply from 2-leaf to the pre-boot stage. No other surfactants are required. See label for tank mix partners. AXIAL may be mixed in a spray solution containing up to 50% liquid nitrogen fertilizer. **Rainfast interval = 30 minutes.**

Resistance Management: *ACCase-resistant (MOA=1) Italian ryegrass has been documented in South Carolina. Continued reliance on ACCase-inhibiting products, such as ACHIEVE and AXIAL, will enhance selection and spread of resistant biotypes. Therefore, consider adding AXIOM, FIERCE, ZIDUA, or PROWL H2O to your herbicide program for resistance management.*

Banvel 4SL (*dicamba*)	2.0-4.0 fl oz	0.0625-0.125 lb	4	7 days	24 hours
Clarity 4SL					

Comments: *Labeled for wheat, barley, and oat.* Apply BANVEL or CLARITY after tillering but before crop reaches the jointing growth stage. Do not tank mix 2,4-D with BANVEL or CLARITY in oat. Best results are obtained if applied when daytime temperatures are above 50 F. Liquid nitrogen may be used as the carrier. **Rainfast interval = N/A (suggest 1 hour minimum).**

Beyond 1 AS (*imazamox*)	4.0-6.0 fl oz	0.031-0.047 lb	2	0 days	4 hours

Comments: USE ONLY on CLEARFIELD WHEAT VARIETIES! Apply BEYOND from the two to four leaf stage to control annual bluegrass, Italian ryegrass, wild radish, and henbit. Apply with NIS at 2 qt/100 gal and UAN at 1-2 qt/A or AMS at 1.5-3 lbs/A. Do not apply more than 8 oz/A per season. **Rainfast interval = 1 hour.**

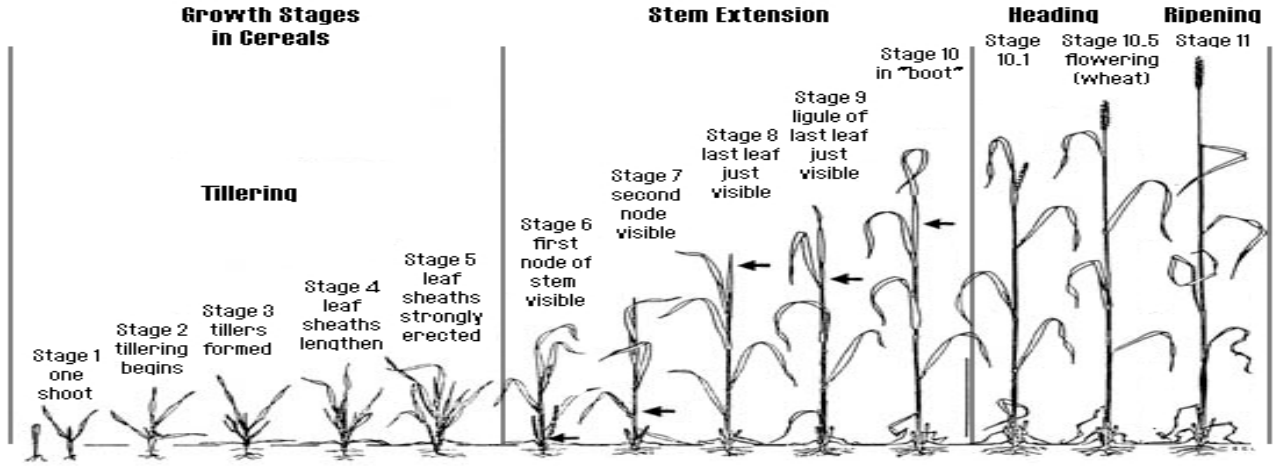
Buctril 4 EC (*bromoxynil*)	0.75-1.0 pt	0.375-0.5 lb	6	45 days	24 hours

Comments: *Labeled for wheat, oats, rye, and barley.* Apply from emergence to boot stage; best results are obtained when applied during the fall. Controls several annual broadleaf weeds. In wheat and barley, BUCTRIL may be tank mixed with HOELON for increased weed spectrum. Do not exceed 1 pt/A per season of BUCTRIL. **Rainfast interval = N/A (suggest 1 hour minimum).**

Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Express 75 WDG (*tribenuron*)	0.25-0.5 oz	0.012-0.023 lb	2	45 days	12 hours
Comments: *Labeled for wheat and barley only*. Apply EXPRESS after 2-leaf stage up to flag leaf emergence. Add 0.5 to 4 pt of NIS per 100 gal of spray solution plus 2 qt/A of UAN or 2 lb/A of AMS. EXPRESS alone provides partial control of wild garlic, henbit, and wild radish. Tank mix with 0.25 to 0.375 lb a.i. of MCPA for improved control of wild radish (less than 6" diameter rosette). **Rainfast interval = 2-3 hours.**					
Finesse 75 WDG (*chlorsulfuron* + *metsulfuron*)	0.2-0.4 oz	0.0078-0.0156 lb + 0.0016-0.0031 lb	2 + 2	None	4 hours
Comments: *Labeled for wheat and barley only*. Apply FINESSE from the 1-leaf stage up to before the boot stage. Add a non-ionic surfactant at 0.125 to 0.5% v/v (0.5 to 2 qt per 100 gal of spray solution). Do not apply FINESSE within 60 days of an in-furrow organophosphate insecticide application. Plant only STS-soybeans following wheat/barley harvest. Do not apply more than one application of FINESSE per growing season. **Rainfast interval = 6 hours.**					
Harmony Extra 50SG (*thifensulfuron* + *tribenuron*)	0.45-0.9 oz	0.0094-0.0188 lb + 0.0047-0.0094 lb	2	45 days	12 hours
Nimble 75 WDG	0.3-0.6 oz		2		
Comments: *Labeled for wheat, barley, and oats. The maximum is rate for HARMONY EXTRA SG in oats* is 0.6 oz/A (0.4 oz/A NIMBLE/HARMONY EXTRA XP). For control of small (2-4 inches), actively growing broadleaf weeds including wild radish and henbit. Apply when wild garlic is less than 12 inches tall. Apply to crop after the 2-leaf stage but before flag leaf is visible. Add NIS at 1 qt/100 gallons of spray solution. For wild radish control in barley and wheat, use 0.6-0.9 oz/A rate of HARMONY EXTRA 50 SG with TotalSol (0.5-0.6 oz of HARMONY EXTRA XP 75 DF or NIMBLE 75 WDG). Do not tank mix with MALATHION insecticide or severe crop injury will occur. If liquid nitrogen is the carrier, reduce surfactant rate to 0.5-1.0 pt per 100 gal of solution (to reduce potential foliar burn). For improved control of wild radish, tank mix 2,4-D or MCPA. Do not use surfactant if applying with 2,4-D or MCPA in nitrogen carrier. **Rainfast interval = 2-3 hours.**					

Feekes Growth Stages of Cereals:



Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Huskie 2.06EC (*pyrasulfotole* + *bromoxynil*)	11-15 fl oz	0.027-0.036 lb + 0.15-0.20 lb	27 + 6	60 days	24 hours
MCPA amine 4L	0.5-1.0 pt	0.25-0.5 lb	4	7 days	48 hours
MCPA ester 4L	0.5-1.0 pt	0.25-0.5 lb			
Osprey 4.5SC (*mesosulfuron*)	4.75 oz	0.013 lb	2	30 days	4 hours
Peak 57DG (*prosulfuron*)	0.5 oz	0.0178 lb	2	60 days	12 hours

Comments: *Labeled for wheat, barley, rye, and triticale*. HUSKIE is a RESTRICTED USE PESTICIDE. Apply HUSKIE in a minimum of 10 gallons of water per acre from the fully expanded first true leaf up to flag leaf emergence. See product label for instructions for aerial applications of HUSKIE. Add NIS at 1 qt per 100 gal of spray solution plus AMS at 1 lb/A. Do not use air induction or flood jet nozzles for ground applications of HUSKIE. Treat broadleaf weeds when they are small and actively growing. Do not apply more than 15 fl oz/A of HUSKIE per application. Do not make more than one application of HUSKIE per season. Do not apply HUSKIE in a tank mixture with a TEBUCONAZOLE fungicide. Tank mixing HUSKIE with fungicides may cause temporary yellowing, leaf burn, and/or height reduction of the crop. Do not graze or harvest forage within 25 days, grain and straw within 60 days after application. **Rainfast interval = 1 hour.**

Comments: *Labeled for wheat, barley, oats, and rye*. For control of winter weeds, such as wild mustard, wild, and shepherdspurse apply after crop has reached to 3- to 4-leaf stage up to the boot stage. Do not graze or harvest forage on treated areas within 7 days of slaughter. **Rainfast interval = N/A (suggest 1 hour).**

Comments: *Labeled for wheat only.* For control ACC-ase annual ryegrass and other broadleaf weeds. Applications may be made from time of emergence up to the jointing stage of development. Apply with NIS at 2 qt/100 gal and UAN at 1-2 qt/A or AMS at 1.5-3 lb/A. MSO at a rate of 1.5 pt/A in a minimum of 10 gallons carrier per acre may be substituted for the NIS and nitrogen additives. OSPREY may be applied in a fertilizer solution; however, nitrogen must not exceed 15% of the total volume (1.5 gallons of Nitrogen in 10 gallons of spray solution). A NIS at 1 qt/100 gal is required for fertilizer carrier applications. The use of a fertilizer/water carrier will increase potential for crop response. Tank mix partners include MCPA, BUCTRIL, EXPRESS, FINESSE, HARMONY EXTRA, STRATEGO, TILT, TOPSIN M, WARRIOR, SEVIN XLR, Z-CYPE. Do not apply more than 4.75 oz/A per season. Do not tank mix and apply OSPREY with MALATHION, MANCOZEB, DI-SYSTON, or METHYL PARATHION. **Rainfast interval = 4 hours.**

Resistance Management: *ALS-resistant (MOA=2) Italian ryegrass has been documented in South Carolina. Continued reliance on ALS-inhibiting products, such as OSPREY and POWERFLEX, will enhance selection and spread of resistant biotypes. Therefore, consider adding AXIOM, FIERCE, ZIDUA, or PROWL H2O to your herbicide program for resistance management.*

Comments: *Labeled for wheat, barley, triticale, rye, and oats*. Apply to crop after spike stage but before the 2nd node (Feekes scale 7) is detectable during elongation. For control of small (2-6 inches), actively growing winter weeds including wild radish, wild mustard, shepherdspurse, and wild garlic. Apply when wild garlic is less than 8 inches tall. Add NIS at 1 qt/100 gallons of spray solution. Do not make foliar or soil application of any organophosphate insecticide within 15 days before or 10 days after PEAK application. Do not irrigate with 4 hours of PEAK application. Do not apply PEAK to crops that under severe stress due to drought, cold weather, hail, wind damage, sand blasting, flooding, or nutrient defienciency. Tank mix partners include BANVEL, BUCTRIL, MCPA, and 2,4-D. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
PowerFlex 7.5DF (*pyroxsulam*)	3.5 oz	0.016 lb	2	60 days	12 hours
PowerFlex HL 13DF	2.0 oz				

Comments: *Labeled for wheat only.* For control of ACCase-resistant annual ryegrass and other annual grass and broadleaf weeds. Apply from 3-leaf to jointing stage. Apply with NIS at 1 to 2 qt/100 gal of spray solution or COC at 1.0-1.25 gal/ 100 gal of spray solution. Application of ammonium nitrogen fertilizer (topdress) 7 days before or after an application of POWERFLEX/HL can result in stunting and foliar crop burn; therefore, do not apply topdress during this time period. If applied in fluid fertilizer, reduce NIS rate to 1 qt/100 gal of spray solution. Do not apply an organophosphate insecticide within 5 days before or 5 days after an application of POWERFLEX/HL. Do not apply more 0.016 lb ai of PYROXSULAM per acre per growing season. Do not cut treated crop for hay within 28 days following application. Do not graze treated crop within 7 days of application. **Rainfast interval = 4 hours.**

Resistance Management: *ALS-resistant (MOA=2) Italian ryegrass has been documented in South Carolina. Continued reliance on ALS-inhibiting products, such as OSPREY and POWERFLEX, will enhance selection and spread of resistant biotypes. Therefore, consider adding AXIOM, FIERCE, ZIDUA, or PROWL H2O to your herbicide program for resistance management.*

Prowl H2O 3.8 CS (*pendimethalin*)	1.5-3.0 pt	0.71-1.43 lb	3	60 days	24 hours

Comments: *Labeled for wheat only.* Apply PROWL H2O prior to weed emergence from the 1-leaf growth stage up to before the flag leaf is visible. Emerged weeds will not be controlled by PROWL H2O. Plant wheat seed at least 1/2-inch to 1-inch deep to avoid crop injury. Do not apply more than 3.0 pt of PROWL H2O per acre per season.

Quelex 20DF	0.75 oz			60 days	12 hours
(*halauxifen-methyl*		0.00047 lb	2		
+		+			
florasulam)		0.00047 lb	4		

Comments: *Labeled for wheat, barley, and triticale*. Apply QUELEX from the 2-leaf growth stage up to flag leaf emergence. Target application when broadleaf weeds are actively growing and in the 2 to 4 leaf growth stage (less than 4 inches tall or diameter). Applications during warm, wet conditions will enhance QUELEX activity on broadleaf weeds; however, cold and/or dry conditions may result in erratic control and subsequent weed regrowth.

Sentrallas 1.55OD	7-14 fl oz			45 days	24 hours
(*thifensulfuron*		0.014-0.027 lb	2		
+		+			
fluroxypyr)		0.07-0.14 lb	4		

Comments: *Labeled for wheat, barley, and oats*. The maximum use rate for oats is 9 fl oz/A. Apply SENTRALLAS from the 2-leaf growth stage up to just before flag leaf emergence. Add non-ionic surfactant at 0.5 to 2.0 pt per 100 gallon of spray solution plus an ammonium containing fertilizer, such as AMS at 2 qt/A or UAN at 2 lb/A. Target application when broadleaf weeds are actively growing and less than 4 inches tall or diameter. Warm and moist conditions will promote weed growth and enhance SENTRALLAS activity on broadleaf weeds; however, cold or drought stress may result in lack of satisfactory control and subsequent weed regrowth. Do not apply SENTRALLAS to wheat, oat, or barley that is stressed by drought, low fertility, water saturated soil, disease or insect damage, as crop injury may occur, particularly during the 2- to 5-leaf growth stage. Do not make more than one application of SENTRALLAS per year in oats. Tank mix partners include 2,4-D, MCPA, DICAMBA, EXPRESS, ALLY, WIDEMATCH, or STINGER. Do not use SENTRALLAS plus MALATHION insecticide because crop injury may occur. Do not graze or harvest treated forage within 7 days of application. Do not harvest treated hay within 30 days of application. **Rainfast interval = 1 hour.**

Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
WideMatch 1.5EC (*clopyralid* + *fluroxypyr*)	1.0-1.33 pt	0.09375-0.125 lb + 0.09375-0.125 lb	4 + 4	40 days	12 hours
Comments: *Labeled for wheat, barley, and oats*. Apply from the 3-leaf growth stage up to flag leaf emergence. For control of weeds (less than 4 inches tall), such as chickweed, curly dock, red sorrel and thistles. Do not apply more than 1.33 pt of WIDEMATCH per acre per growing season. Do not allow livestock to graze treated areas or harvest treated forage within 7 days of application. WIDEMATCH may be tank mixed with other products labeled for postemergence applications in wheat, barley, and oats. Do not apply under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval = N/A (suggest 1 hour).**					
2,4-D 4L amine/ester	0.5-1.0 pt	0.25-0.5 lb	4	14 days	12 hours
Comments: *Labeled for wheat, barley, oats, and rye*. Oats are less tolerant of 2,4-D than barley, wheat, or rye. For fall seeded oats, use the lower rate to avoid injury. For control of weeds such as vetch, wild mustard and radish, apply after crop is fully tillered but before jointing. Do not apply under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval = N/A (suggest 1 hour).**					

Harvest Aids for Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Glyphosate acid equivalent (ae)			9	7 days	12 hours
5.5 SL (4.5 lb ae)	22 fl oz	0.75 lb ae			

Comments: *Labeled for wheat and barley*. Apply GLYPHOSATE after hard dough stage of grain (30% or less grain moisture) at least 7 days before harvest. Do not apply to wheat or barley grown for seed. Do not apply more than 0.75 lb ae/A for a preharvest application. **Rainfast interval = N/A (suggest 1 hour).**

Valor SX 51WDG (*flumixoazin*)	1.5-2.0 oz	0.048-0.064 lb	14	10 days	12 hours
Valor EZ 4SC	1.5-2.0 fl oz				

Comments: *Labeled for wheat only*. Apply VALOR SX after wheat reaches the hard dough stage and grain moisture is less than 30%. GLYPHOSATE is the recommended tank mix partner to control existing weeds and aid in harvest. Apply in a minimum of 10 gallons spray solution per acre by ground application and a minimum of 5 gallons per acre by aerial application. For proper desiccation, add a methylated seed oil which contains at least 15% emulsifiers and 80% oil at 1 qt/A plus a spray grade nitrogen source (either ammonium sulfate at 2-2.5 lb/A or 28-32% nitrogen solution at 1-2 qt/A). **Rainfast interval = N/A (suggest 1 hour).**

Sharpen 2.85 SC (*saflufenacil*)	1.0-2.0 fl oz	0.022-0.045 lb	14	3 days	12 hours

Comments: *Labeled for use in wheat, barley, and triticale*. Apply SHARPEN after crop has reached physiological maturity (hard dough stage and grain moisture is less than 30%). Thorough spray coverage is essential for optimum dessication and weed control. Apply in a minimum spray volume of 10 gallons per acre by ground and 5 gallons per acre by air. Add methylated seed oil (MSO) at 1 gal per 100 gal plus ammonium sulfate (AMS) at 8.5 to 17 lbs per 100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals per 100 gals of spray volume. Do not apply more than 2.0 fl oz/A of SHARPEN per cropping season for dessication uses. SHARPEN may be tank mixed with GLYPHOSATE for additional preharvest weed dessication (increases PHI to 7 days). Do not apply SHARPEN to barley, wheat, or triticale grown for seed production. SHARPEN treated barley, wheat, and triticale straw may be grazed or fed to livestock.

2,4-D 4L amine/ester	1.0 pt	0.5 lb	4	14 days	12 hours

Comments: *Labeled for wheat, barley, oats, and rye*. Apply 2,4-D when grain is in the hard dough stage or later to control weeds that may interfere with harvest or to suppress perennial weeds at least 14 days before harvest. Do not apply from early boot to milk stage of growth development. Do not apply more than 1.0 pt/A per application or under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval = N/A (suggest 1 hour).**

SMALL GRAIN INSECT CONTROL

David Gunter, Extension Feed Grain Specialist

Pest	Product	Rate /acre	Comments
aphids	**Seed Treatments**		Preventative aphid treatment for barley yellow dwarf virus suppression is recommended for high yield wheat and oat production under SC conditions. Either seed treatment or foliar pyrethroid application are both effective.
	Enhance AW	4.0 oz / 100 lb	
	Gaucho 600, Axcess, Attendant 600 Gaucho XT	0.8 fl oz / 100 lb	
	Cruiser 5FS	3.4 fl oz / 100 lb	Seed treatments provide early season control of aphids and barley yellow dwarf. Seed treatments also suppress Hessian fly, but will not control heavy HF infestations. For Hessian fly suppression, Enhance AW 4 oz / 100 lb, 1.6 fl oz / 100lb Gaucho 600, or 1.33 fl oz / 100lb Cruiser is recommended.
	NipsIt Inside	1.0 fl oz / 100 lb	
	Foliar	0.75-1.79 fl oz/ 100 lb	
	Karate Z, others		
	Warrior, Silencer, others, 1EC	1.3 – 1.9 oz (1 gal / 100-66 ac)	A foliar pyrethroid application in topdress N by mid-February (early Feb. better yet) is also highly effective in suppressing aphid virus transmission.
	Baythroid XL 1EC	2.6 – 3.8 oz (1gal /50-33 ac)	Aphid treatments are most likely to be profitable on early-planted high-yield-potential wheat (60+ bu/ac). The key pest is the **oat-bird cherry aphid** which is the major vector or carrier of barley yellow dwarf virus. This aphid typically has a dark green body with reddish area on the "rear end".
	Declare, Prolex		
	Proaxis 0.5	2.4 fl oz (1 gal / 53 ac)	If preventative treatment was not previously applied, aphid treatment is recommended if you find 8 oat-bird cherry aphids per row foot prior to jointing.
	Sivanto	1.0 – 1.5 fl oz (1 gal / 128-85 ac)	**Oats are more susceptible to barley yellow dwarf than wheat. Enhance AW hopper box seed treatment is recommended to control aphids and smut on oats. If a foliar pyrethroid is used to control aphids on oats, treatment should be earlier (Dec. – Jan.) than on wheat.**
	Transform	2.6 – 3.8 fl oz (1 gal / 49-33 ac)	Karate, Warrior, Silencer have been particularly effective in suppressing barley yellow dwarf virus on oats and wheat and giving season-long protection against later head infestation by English grain aphids on wheat.
		7 – 10.5 fl oz	**English grain aphids** (light green bodies with long black "exhaust pipes" protruding upward from rear end) increase during jointing and move to heads as they emerge in April.
		0.75 fl oz	**The treatment guideline for English grain aphid is 2-3/stem during jointing; 5/stem at head emergence to blooming; 10/stem at milk; dough stage is too late to spray. Wheat treated earlier for virus prevention should not have significant aphid infestation of the heads.**

Pest	Product	Rate /acre	Comments
Cereal Leaf Beetle	Baythroid XL	1.0 – 1.8 fl oz	Cereal leaf beetles first hatch out in March and peak feeding occurs in April. **Treat if you have 1 larva on every other stem (average of 0.5 larvae / stem).**
	Karate Z, others	1.3 – 1.9 oz	
	Warrior, Silencer, others, 1EC	2.6 – 3.8 oz	Karate, Warrior, Silencer also provide season-long aphid control.
	Mustang MAX		
	Respect 0.8 EC	2.6 – 3.2 oz	
	Declare, Prolex		
	Proaxis 0.5	1.0 – 1.5 fl oz	
	Tombstone 2.0	2.6 – 3.8 fl oz	Do not make more than 2 applications of Blackhawk per season. If additional treatments are required, rotate to another effective class of insecticides.
	Blackhawk	2.4 oz	
		1.1 – 3.3 oz	
True Armyworm	Baythroid XL 1 EC	1.8 – 2.4 fl oz	**Treat when armyworm populations reach 2 per drill ft.** True armyworm infestations usually occur after flag leaf emergence.
	Karate Z, others		
	Warrior, Silencer, others, 1EC	1.9 oz 3.8 oz	
	Lannate LV		
	Lannate 90 SP	1.5 pt 0.5 lb	Karate or Warrior treatment also provides season-long aphid control.
	Mustang MAX		
	Respect 0.8 EC	3.2 oz	
	Declare, Prolex		
	Proaxis 0.5	1.5 fl oz 3.8 fl	
	Radiant 1 SC		
		3 – 6 oz	Do not make more than 2 applications of Blackhawk per season. If additional treatments are required, rotate to another effective class of insecticides.
	Tombstone 2.0	2.4 oz	
	Blackhawk		
		1.1 – 3.3 oz	

Pest	Product	Rate /acre	Comments
Fall Armyworm	Sevin 80S Sevin XLR Sevin 4F Karate Z, others Warrior, Silencer, others, 1EC Lannate LV Lannate 90 SP Mustang MAX Respect 0.8 EC Declare, Prolex Proaxis 0.5 Radiant 1 SC Tombstone 2.0 Blackhawk	1.75 lb 1.5 qt 1.5 qt 1.9 oz 3.8 oz 1.5 pt 0.5 lb 3.2 oz 1.5 fl oz 3.8 fl oz 3 – 6 oz 2.4 oz 1.7 – 3.3 oz	**Treat if the stand is threatened before frost.** Fall armyworm infestations may occur on early planted seedling stage small grain. Do not make more than 2 applications of Blackhawk per season. If additional treatments are required, rotate to another effective class of insecticides.
Grasshoppers	Baythroid XL Karate Z, others Warrior, Silencer, others, 1EC Malathion 8 EC Malathion 57 EC Methyl Parathion 4 EC Penncap-M Mustang MAX, Respect 0.8 EC Declare, Prolex Proaxis 0.5 Tombstone 2.0	2.4 fl oz 1.9 oz 3.8 oz 1.25 pt 2.0 pt 1 pt 2-3 pt 3.2 – 4.0 oz 1.5 fl oz 3.8 fl oz 2.4 oz	Grasshoppers typically attack wheat after flag leaf emergence. There are no well established thresholds for grasshopper treatment. Prevent flag leaf defoliation.
Spider Mites / Winter Grain Mite	Methyl Parathion 4 EC Penncap-M	1 – 1.5 pt 2 -3 pt	Treat when mites are present and causing leaf discoloration. Late season (dough stage) populations are unlikely to cause economic injury.

Pest	Product	Rate /acre	Comments
Hessian Fly	**Varietal resistance is the most economical way to manage Hessian fly.** HF resistance declines over time and varies by location depending on the predominant races of Hessian fly present. Treat susceptible varieties on farms with a history of economic damage. Proximity to wheat stubble from previous crop increases HF risk. **When possible, try to rotate wheat blocks at least 1/3 – 1/2 mile away from previous year's stubble. Wheat planted in the coastal plain before 15 Nov is most susceptible to HF.** Wheat, barley, and triticale are susceptible to HF. Rye has low susceptibility to Hessian fly and oats are immune to any injury.		
Hessian Fly (continued)	<u>Seed Treatment</u> Enhance AW Gaucho 600, Axcess Attendant 600 Cruiser 5FS Gaucho XT + Gaucho 600 Cruiser 5FS <u>Foliar</u> Karate Z, others Warrior, Silencer, others, 1EC Declare, Proaxis	 4 oz / 100 lb 2.4 fl oz/100 lb 3.4 fl oz + 1.0 fl oz / 100 lb 1.33 fl oz / 100 lb 1.9 oz 3.8 oz 1.54 oz 3.84 oz	Barley is tolerant. Damage only occurs under severe infestations. Rye is highly resistant and oats are immune to Hessian fly. Seed treatments will suppress but not control Hessian fly. Seed treatments also provide early season control of aphids and barley yellow dwarf. Enhance AW and Gaucho XT also control smut and certain seedling diseases. Gaucho XT only has one-half the insecticide active ingredient of the 1.6 oz rate of Gaucho 600. Adding 0.8 oz Gaucho 600 to Gaucho XT gives the same level of a.i. as 1.6 oz Gaucho 600. Foliar treatment at early post emergence (2-4 leaf stage) may reduce fall infestation on susceptible varieties. March treatment (jointing) timed to spring HF egg laying is recommended if 10% of stems are infested by February.
Insecticide seed treatment note: The amount of insecticide active ingredient actually applied to 100 lb of seed for labeled rates of imidicloprid formulations is as follows: Enhance AW 4 oz (0.05 lb ai); Gaucho XT 3.4 fl oz (0.03 lb ai) + Gaucho 600 1.6 fl oz (0.06 lb ai) = 0.094 ai; Gaucho 600 2.4 fl oz (0.094 ai).			

Small Grain Insecticide Use Precautions

Active Ingedient	Brand Name	Pre-Harvest (Days)	Pre-Grazing (Days)	Small Grains Labeled
beta-cyfluthrin	Baythroid XL 1 EC	30	7	wheat
carbaryl	Sevin	21	7	wheat, triticale
cyfluthrin	Tombstone 2.0	30	7	wheat, triticale
flupyradifurone	Sivanto 200 SL	21	no grazing restriction	wheat, oats, barley, rye, triticale
imidacloprid	Enhance AW, Gaucho	45	45	wheat, oats, barley
lambda-cyhalothrin	Karate Z 2.08 Warrior	30	7	wheat, oats, barley, rye, triticale
gamma cyhalothrin	Declare, Proaxis 0.5	30	7	wheat, triticale
malathion	Malathion	7	7	wheat, oats, barley, rye, triticale
methomyl	Lannate	7	10	wheat, oats, barley, rye, triticale
methyl parathion	Methyl 4EC Penncap-M	15	15	wheat, oats, barley, rye, triticale
spinetoram	Radiant 1 SC	21	3	wheat, oats, barley, rye, triticale
spinosad	Tracer Blackhawk	21 21	14 once material dries	wheat, oats, barley, rye, triticale
sulfoxaflor	Transform 50WG	14	7	wheat, barley, triticale
thiamethoxam	Cruiser 5FS	seed treat.	no grazing restriction	wheat, barley, triticale
zeta-cypermethrin	Mustang MAX Respect 0.8 EC	14	14	wheat, triticale

STORED SMALL GRAIN INSECT PROTECTION

Robert G. Bellinger, Entomology & Extension Pesticide Coordinator

Empty Bin Residual Treatment		
Treatment	**Comments**	
Centynal	Do not allow runoff, for residual use only	
Diacon IGR, Diacon D IGR	Diacon will not kill adults, only immatures.	
Nylar	Insect growth regulator	
Storcide II	Application can only be made from outside bin using automated equipment. See label.	
Tempo Tempo SC Ultra	Apply to all interior surfaces and allow to dry before storage. Do not apply to grain. See label.	
Empty Bin Fumigation		
Treatment	**Comments**	
Phostoxin Phosfume Weevil-cide	Fumigate empty bin after thorough bin clean-out and interior residual treatment. Extremely toxic RUP with strict application procedures. No residual control.	
Profume	For use only by licensed fumigators trained under Dow AgroSciences' PRECISION FUMIGATION Program.	
Grain Protectants		
Treatment	**Rate**	**Comments**
Storcide II	12.5 oz / 5gal / 1000 bu wheat 9.9 oz / 5gal / 1000 bu barley 6.6 oz / 5gal / 1000 bu oats	Apply to grain stream as a course spray. See label.
Diacon IGR	14 fl oz / 1000 bu wheat 12 fl oz/ 1000 bu barley 8 fl oz / 1000 bu oats	See label.
Diacon D IGR	8 – 10 lb / 1000 bu (wheat oats, barly, rye, triticale)	Apply dust as uniformly as possible. See label.
Centynal	7.3 – 9.1 fl. ozs./5 gal. water/1,000 bu. (wheat oats, barly, rye)	See label
Diatomaceous earth DE Insecto	1-2 lbs./ton of grain to top 2-3 ft. of grain.	May meet organic requirements.
Grain Topdressing		
Biobit HP Dipel DF Javelin	Bt products. 1lb./10-20 gal. water/1,000sq.ft. Apply and rake into top 4 inches of grain; see label instructions.	
Diacon IGR, Diacon D IGR	1ml./1000 sq. ft. Diacon will not kill adults, only immatures. 8lbs/1000 sq. ft. Rake to depth of 1 foot.	
Diatomaceous earth DE Insecto	4lbs./1,000sq. ft. Especially for Indian meal moths. Apply at monthly intervals. May meet organic requirements.	
Grain Fumigants		
Treatment	**Comments**	
Al phosphide Mg phosphide ProFume ECO2FUME	Fumigation should only be performed by trained and certified applicators. Consult labels for certification / licensing requirements.	

Small Grain Disease Control

David Gunter, Extension Feed Grain Specialist

Diseases	Product	Rate Fl oz / Ac	Comments
Powdery Mildew, Leaf Rust, Leaf /Glume Blotch, Tan Spot, Stripe Rust	Aproach Aproach Prima Caramba Tebuconazole (generic Folicur) Headline 2.1 Priaxor Proline Prosaro Quadris 2.1 F Quilt QuiltXcel Stratego YLD Twinline Tilt 3.6 EC PropiMax 3.6 EC	6 - 12 oz 3.4 - 6.8 oz 10 oz 4 oz 6 - 9 oz 4 - 8 oz 4.3 - 5.7 6.5 oz 6.2 -10.8 oz 10 -14 oz 7 - 14 oz 4 oz 9 oz 4 oz 4 oz	**The most effective preventative fungicide timing for wheat yield response is usually just after the flag leaf has fully emerged (boot stage).** This flag leaf application usually controls the two greatest yield threats – leaf rust and glume blotch. If head scab is a concern, a slightly later timing (see comments below) still provides some rust and glume blotch protection. Wheat with 60 bu/ac yield potential is most likely to respond to fungicide treatment. Treat **powdery mildew** if 20 % of leaf area is infected on leaf below flag leaf, and cool (high < 75 F), wet weather predicted. **NOTE:** Early treatments for powdery mildew during tillering do not provide adequate residual control of rust infections. **Leaf Rust** susceptible varieties should be treated preventatively at fully emerged flag leaf, or at the first sign of rust if earlier. Treat for **leaf/glume blotch** or **tan spot** if 25 % of stems have a lesion on leaf below flag leaf. Thus far economic injury from **stripe rust** has been rare in SC. Stripe rust is a very aggressive disease which responds best to preventative treatment of the emerged flag leaf. Standard preventative treatment at flag leaf emergence should prevent damage under S. C. conditions. If a rescue treatment is needed for stripe rust (not common leaf rust) use Tilt.
Head Scab	Caramba Tebuconazole Proline Prosaro	14 – 17 oz 4 oz 5.0 – 5.7 oz 6.5 – 8.5 oz	Applications for head scab should be made when 50% of the heads are fully emerged. Scab suppression requires excellent coverage of the heads. See label for nozzle and spray volume recommendations. Harvest Restriction is 30 days.

Smuts and Seedling blights	Product	Rate fl or dry oz per 100 lb Seed	Comments
	Baytan 30	0.75-1.5 oz	
	RTU Baytan-Thiram	4.5-9.0 oz	**Note:** Fungicide seed treatments provide relatively cheap stand insurance and smut protection.
	Dividend XL RTA	5.0-10.0 oz	Grower and commercially applied available.
	Dividend XL	1.0-2.0 oz	
	Dividend Extreme	0.5-1.0 oz	
	Raxil	3.5-4.6 fl oz	Raxil formulated in various combinations with other fungicides, insecticides.
	Gaucho XT	3.4 fl oz	Gaucho XT also control aphids and gives some Hessian fly suppression.
	Vitavax 200	2.0 oz	
	RTU Vitavax-Thiram	2.0-4.0 oz	
	Enhance AW	4 oz	Enhance AW is a hopperbox fungicide and insecticide treatment which also controls aphids and gives some Hessian fly suppression.

Disease Response to Small Grain Fungicides

	Rate (fl oz)	Powdery Mildew	Leaf and Glume Blotch	Tan Spot	Stripe Rust	Leaf Rust	Head Scab
Aproach	6 - 12	G	G	G	E	G - E	P
Aproach Prima	3.4 - 6.8	G - E	G	G	E	G - E	P
Caramba	10 - 17	G	G	F	G-E	E	G
Tebuconazole (generic Folicur)	4	F	G	G	G-E	E	F
Headline	6 - 9	F	G-E	E	G-E	E	P
Proline	4.3 - 5.7	G	G	G	G-E	E	G
Prosaro	6.5 - 8.5	G	G	G	G-E	E	G
Priaxor	4 - 8	G	G	G	G-E	E	F
Quadris	6.2 -10.8	F	G	E	G-E	E	P
Quilt	10 - 14	G-E	G	E	E	E	P
QuiltXcel	7 - 14	G-E	G	E	E	E	P
Stratego YLD	4	E	G	E	G	G	P
Twinline	7 - 9	G-E	G	E	E	E	F
Tilt	4	E	G	G	G	G	P

E=excellent, G=good, F=fair, P=poor

Small Grain Fungicide Use Precautions

Active Ingedient	Brand Name	Application Restriction	Small Grains Labeled
Foliar Fungicides			
azoxystrobin	Quadris	up to flowering	wheat, barley
metconazole	Caramba	30 day preharvest	wheat, barley, oats, rye triticale
metconazole + pyraclostrobin	Twinline, Multiva	30 day preharvest	wheat, barley, oats, rye triticale
picoxystrobin	Aproach	up to flowering	wheat, barley, oats, rye triticale
picoxystrobin + cyproconazole	Aproach Prima	45 day preharvest	wheat, triticale
propiconazole	Tilt, PropiMax, Bumper	up to flowering	wheat, barley, rye, oats
propiconazole + azoxystrobin	Quilt, QuiltXcel	up to flowering	wheat, barley, triticale
propiconazole + trifloxystrobin	Stratego	up to fully emerged flag leaf	wheat
prothioconazole	Proline	30 day preharvest	wheat, barley, oats, rye, triticale
prothioconazole + tebuconazole	Prosaro	30 day preharvest	wheat, barley, oats
pyraclostrobin	Headline	up to flowering	wheat, rye, barley
tebuconazole	Orius, Monsoon, Tebuzol, etc.	30 day preharvest	wheat, barley
Seed Treatments			
carboxin + captan	Enhance AW	seed treatment	wheat, barley, oats
carboxin-thiram	Vitavax 200, RTU Vitavax-Thiram	seed treatment	wheat, oats, barley, rye
difenoconazole + metalaxyl	Dividend XL, Dividend Extreme	seed treatment	wheat, barley
fludioxonil	Maxim 4FS	seed treatment	wheat, oats, barley, rye, triticale
mefenoxan	Apron XL, Apron XL-LS	seed treatment	wheat, oats, barley, rye, triticale
sedaxane + difenoconazole + mefenoxam	Vibrance Extreme	seed treatment	wheat, oats, barley, rye, triticale
tebuconazole	Raxil	seed treatment	wheat oats, barley
triadimenol	Baytan 30	seed treatment	wheat, oats, barley, rye

SOYBEAN WEED CONTROL

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC/1.9EW (*carfentrazone*)	1.0-2.0 oz	0.016-0.032 lb	14	3 days	12 hours
Comments: Apply any time before planting. For best results, apply when weeds are less than 4 inches tall (less than 3 inch rosettes). Use higher rate for treating larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution), or MSO (1-2 gal per 100 gals of spray solution). Add 2,4-D to improve control of cutleaf eveningprimrose and wild radish. Tank mix partners include GLYPHOSATE, LIBERTY, GRAMOXONE, 2,4-D LVE, or CLARITY. **Rainfast interval = 6-8 hours.**					
Clarity 4S (*dicamba*) Banvel 4S	4.0-16 oz	0.13-0.5 lb	4	---	24 hours
Comments: Apply CLARITY or BANVEL to control emerged broadleaf weed before soybean planting. Following an application of CLARITY or BANVEL and a minimum accumulation of 1" rainfall or overhead irrigation, a waiting interval of 14 days is required for 8 oz/A or less and 28 days for 16 oz/A. These intervals must be observed before planting soybeans or crop injury may occur. **Rainfast interval = 4 hours.**					
Envive 41.3DF	2.5-4.0 oz			---	12 hours
(*chlorimuron* + *flumioxazin* + *thifensulfuron*)		0.014-0.023 lb + 0.046-0.073 lb + 0.005-0.007 lb	2 14 2		
Comments: Apply ENVIVE 7 to 14 days before soybean planting. To ensure proper coverage of target weeds (1-3" tall), use 10 to 30 gallons of spray solution per acre. ENVIVE may be tank mixed with 2,4-D LVE, GLYPHOSATE, CLARITY, or GRAMOXONE. If tank mixing with 2,4-D, observe the more restrictive waiting interval for (14-30 days, depending on rate). **Rainfast interval = 1 hour.**					
ET 0.208EC (*pyraflufen ethyl*)	0.5-2.0 oz	0.0008-0.003 lb	14	---	12 hours
Comments: Soybean may be planted any time after ET application. For best result, apply ET to broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter. Do not apply more than 2.0 oz/A for burndown. Add a suitable adjuvant like NIS at 1.0% v/v (1 gal per 100 gal of spray solution) to optimize weed control. Ground application requires minimum of 10 gallons/A. Do not allow livestock to graze in treated areas. **Rainfast interval = 1 hour.**					

Preplant/Burndown Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Fierce 76DF	3.0-3.75 oz			---	12 hours
(*flumioxazin*		0.063-0.079 lb	14		
+		+			
pyroxasulfone)		0.080-0.100 lb	15		
Comments: Apply FIERCE anytime before soybean planting. Do not apply more than 3.75 oz/A of FIERCE during a single growing season. Add a COC at 1 pt/A or NIS at 0.5% v/v (2 qt per 100 gal of spray solution) plus AMS at 17 lbs per 100 gal of water. Tank mix partners include 2,4-D LVE, COMMAND, EXTREME, METRIBUZIN, FIRSTRATE, GLYPHOSATE, LIBERTY, LOROX, PARAQUAT, PURSUIT PLUS, PENDIMETHALIN, PYTHON, SCEPTER, SELECT MAX, VALOR, and VALOR XLT. Spray equipment, including mixing vessels and nurse tanks, must be cleaned each day following FIERCE application.					
FirstRate 84WDG (*chloransulam-methyl*)	0.3-0.8 oz	0.016-0.042 lb	2	65 days	12 hours
Comments: Apply FIRSTRATE up to 14 days before planting soybean. Provides control of marestail up to 6 inches in height. For improved control of emerged weeds at the time of application, tank mix FIRSTRATE with 2,4-D LVE, GRAMOXONE, or GLYPHOSATE. **Rainfast interval = 2 hours.**					
FirstShot 50SG	0.5-0.8 oz			---	12 hours
(*thifensulfuron*		0.125-0.20 lb	2		
+		+			
tribenuron)		0.125-0.20 lb	2		
Comments: Apply FIRSTSHOT 7 days before soybean planting. If applying to coarse soils, such as sands, loamy sands, and sandy loams, wait an additional 7 days to plant. Add COC at 1 gal/100 gal or NIS at 2 pt per 100 gal of spray solution plus nitrogen fertilizer (UAN at 2 qt/A or AMS at 2 lb/A). FIRSTSHOT may be tank mixed with 2,4-D LVE (improved control of cutleaf eveningprimrose, henbit, and Carolina geranium), GLYPHOSATE, CLARITY, LIBERTY, or GRAMOXONE. If tank mixing with 2,4-D, observe the more restrictive waiting interval for (14-30 days, depending on rate, see 2,4-D comments).					
Flexstar GT 3.29SL	3.0-4.5 pt			45 days	24 hours
(*fomesafen*		0.25-0.37 lb	14		
+		+			
glyphosate)		1.0-1.6 lb	9		
Comments: Apply FLEXSTAR GT 7 to 14 days before soybean planting. FLEXSTAR GT is formulated with built-in adjuvant system which minimizes the need for additional spray adjuvants. Add AMS at 8.5-17 lb per 100 gallons of water. Under conditions where target weeds are under stress including moisture or temperature, add COC or MSO at 2-4 qt per 100 gallons of water or NIS at 1-2 qt per 100 gallons of water. Use of drift control agents is not recommended. Do not exceed 4.5 pt of FLEXSTAR GT per acre per season. **Rainfast interval = 2 hours.**					

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Gangster V 51WDG (*flumioxazin*)	2.5-3.0 oz	0.080-0.096 lb	14	---	12 hours
+	+	+			
Gangster FR 84DF (*chloransulam*)	0.5-0.6 oz	0.026-0.032 lb	2		
Comments: GANGSTER is a co-pack of GANGSTER V and GANGSTER FR. Apply a minimum of 14 days before planting soybeans. If weeds are present, tank mix with GLYPHOSATE, GRAMOXONE, or 2,4-D. Do not tank mix VALOR in soybean fields with products containing flufenacent (AXIOM), alachlor (INTRRO), metolachlor (DUAL), or dimethenamid-p (OUTLOOK) as severe crop injury may occur if prolonged, cool wet conditions follow application. For additional residual grass and broadleaf control, tank mix with PROWL, COMMAND, SCEPTER, METRIBUZIN, PYTHON, LOROX, and/or SQUADRON. *Be sure to follow the clean-out instructions for removing GANGSTER from the sprayer after each day's use; do not let GANGSTER sit overnight in the tank*.					
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22-32 oz	0.75-1.13 lb ae			
Comments: Apply in 10-20 gal of water 2 to 4 weeks prior to your anticipated planting date to control existing groundcover. In most fields, a follow-up application of GRAMOXONE will be needed at planting. Consult product label to determine if a NIS is needed. **Rainfast interval = 2 hours.**					
Goal 2XL (*oxyfluorfen*)	1.0-2.0 pt	0.25-0.5 lb	14	7 days	24 hours
Comments: Apply GOAL 2XL a minimum of 7 days before planting soybeans. Tank mix with GLYPHOSATE or PARAQUAT for control of larger winter annual broadleaf weeds or annual grasses in fallow beds (fall or late winter/early spring burndown). Provides postemergence and soil residual control of horseweed, pigweeds, and henbit.					
Gramoxone SL 2E (*paraquat*)	2.0-4.0 pt	0.5-1.0 lb	22	7 days	12 hours
paraquat 3S	1.5-2.0 pt	0.5-0.75 lb			
Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Apply in a minimum of 10 GPA at planting or as a follow-up to an earlier application of GLYPHOSATE. Controls chickweed, henbit, and cutleaf eveningprimrose better than GLYPHOSATE. Add NIS at 1 qt/100 gal of spray mix. **Rainfast interval = 30 minutes.**					

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Leadoff 33.4WG (*rimsufluron* + *thifensufluron*)	1.5 oz	0.0157 lb + 0.0157 lb	2 + 2	---	4 hours
Comments: Apply LEADOFF a minimum of 30 days before planting soybeans. For best performance, ground application should be a minimum of 15 gallons of water/acre. For control of emerged weeds, add COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal or NIS at 1 qt per 100 gal of spray solution plus nitrogen fertilizer such as UAN (28%-32% N) at 2 qt/A or AMS at 2 lb/A. LEADOFF may be tank mixed with GLYPHOSATE, PARAQUAT, 2,4-D LVE, FIRSTSHOT, CINCH, and DICAMBA.					
Liberty 280 2.34SL (*glufosinate*) Interline 2.34SL	29-36 fl oz	0.53-0.66 lb	10	70 days	12 hours
Comments: Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. Best results obtained when daytime temps exceed 75 F. Consult label for more details. **Rainfast interval = 4 hours.**					
Prefix 5.29EC (*s-metolachlor* + *fomesafen*)	2.0 pt	1.09 lb + 0.23 lb	15 + 14	90 days	24 hours
Comments: Apply PREFIX up to 15 days prior to planting soybeans. If weeds are present at the time of application, tank mix with GLYPHOSATE, GRAMOXONE, or 2,4-D. Dry weather following application may reduce the effectiveness of residual control.					
Python 80WDG (*flumetsulam*)	0.8-1.0 oz	0.04-0.05 lb	2	85 days	12 hours
Comments: Apply PYTHON up to 30 days before planting soybeans. If weeds are present at time of application, tank mix with 2,4-D, GLYPHOSATE, GRAMOXONE, or LIBERTY. Use the lower rate of PYTHON on soils that have a sand or loamy sand texture throughout the profile. Do not use in areas where the soil pH is greater than 7.8 as this may result in unacceptable crop injury.					
Sharpen 2.85SC (*saflufenacil*)	1.0 fl oz	0.022 lb	14	80 days	12 hours
Comments: Apply SHARPEN a minimum of 30 days before planting soybeans for coarse soils with less than 2.0% organic matter. Preplant interval for soils with greater than 2% organic matte is 14 days (1.5 oz/A SHARPEN rate) and 30 days (2.0 oz/A SHARPEN use rate). Add MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). SHARPEN may be tank mixed with GLYPHOSATE, CLARITY, PROWL, PURSUIT, or SCEPTER. SHARPEN may be tank mixed with other MOA=14 products (i.e., VALOR or AUTHORITY) if a minimum of 14 days passes between application and planting. Group 14 herbicides labeled for postemergence application in soybean may be used 14 days after emergence. Do not apply more than 0.089 lb ai/A saflufenacil from all product sources per cropping season. Do not apply SHARPEN within 30 days of planting where an at-planting application of an organophoshate or carbamate insecticide is planned or has occurred or severe crop injury may occur. Soybean forage may be fed or grazed 65 days or more after application. **Rainfast interval = 1 hour.**					

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Synchrony XP 28.4DG (*chlorimuron-ethyl* + *thifensulfuron*)	0.375-0.75 oz/A	0.005-0.010 lb + 0.002-0.003 lb	2 + 2	60 days	12 hours
Comments: Apply SYNCHRONY XP up to 30 days before planting soybeans. Add crop oil concentrate at 1 gal per 100 gal of spray solution plus ammonium sulfate at 2 lb/A or urea ammonium nitrate at 2 qt/A. If weeds greater than 3 inches in height are present, tank mix with one ore more of the following depending on weed spectrum, GLYPHOSATE, 2,4-D LVE, DICAMBA, PARAQUAT, GLUFOSINATE, SHARPEN, or VALOR. Provides limited residual control of sicklepod, common cocklebur, annual morningglory, and marestail. Do not apply more that 0.051 lb ai of chloriumron ethyl per acre per year. Do not apply more 0.047 lb ai of thifensulfuron per acre per year. **Rainfast interval = 1 hour.**						
Valor SX 51WDG (*flumioxazin*)	2.0-3.0 oz	0.064-0.096 lb	14	60 days	12 hours
Valor EZ 4SC	2.0-3.0 fl oz				
Comments: Apply VALOR a minimum of 15 gallons of water at least 14 days before planting soybeans. Add MSO or COC at 1-2 pt per 100 gal of spray mixture or NIS at 0.25% v/v (1 qt per 100 gal of spray mixture). If weeds are present, tank mix with GLYPHOSATE, 2,4-D LVE, or GRAMOXONE. For additional residual grass and broadleaf control, tank mix with PROWL, COMMAND, SCEPTER, METRIBUZIN, PYTHON, LOROX, and/or SQUADRON. Areas (i.e., in the crop rows) that are excessively disturbed during the planting operation may see diminished weed control. *Be sure to follow the clean-out instructions for removing VALOR from the sprayer after each day's use; do not let VALOR sit overnight in the tank*. **Rainfast interval = 1 hour.**						
Valor XLT 40.3WDG	3.0-5.0 oz			---	12 hours
(*flumioxazin* + *chlorimuron*)		0.057-0.094 lb + 0.019-0.032 lb	14 + 2		
Comments: Apply VALOR XLT a minimum of 14 days prior to planting soybeans. For enhanced residual control of weeds in reduced tillage fields, tank mix with BOUNDARY, DOMAIN, ALACHLOR, S-METOLACHLOR, DIMETHENAMID, or FLUFENACET. Areas (i.e., in the crop rows) that are excessively disturbed by the planting operation may see diminished weed control. Do not apply VALOR XLT within 14 days before or after an application of an organophosphate insecticide on any soybean variety that is not STS or STS/RR. *Be sure to follow the clean-out instructions for removing VALOR XLT from the sprayer after each day's use; do not let VALOR XLT sit overnight in the tank*.						

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Verdict 5.57EC	5.0 fl oz			80 days	12 hours
(*saflufenacil*		0.022 lb	14		
+		+			
dimethenamid-p)		0.195 lb	15		

Comments: Apply VERDICT a minimum of 30 days before planting soybeans for coarse (sand, loamy sand, and sandy loam) soils with less than 2.0% organic matter. No preplant interval is required for coarse soils with greater than 2.0% organic matter and all medium/fine soils. Add MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). VERDICT may be tank mixed with GLYPHOSATE or CLARITY. If tank mixing with glyphosate, AMS is recommended. Do not apply VERDICT with other Group 14 products (i.e., AIM, VALOR, VALOR XLT, ET, PREFIX, or AUTHORITY) due to crop injury potential. Group 14 herbicides labeled for postemergence application in soybean may be used 14 days after emergence. Do not apply more than 0.089 lb ai of saflufenacil per acre from all product sources per cropping season. Do not graze or feed treated soybean forage, hay, or straw to livestock. **Rainfast interval = 1 hour.**

Zidua 85WG (*pyroxasulfone*)	1.5-2.1 oz	0.080-0.112 lb	15	None	12 hours

Comments: Apply ZIDUA 15 to 45 days prior to planting soybeans. For enhanced burndown and/or residual control of weeds in reduced tillage fields, tank mix with EXTREME, OPTILL, OUTLOOK, PROWL H2O, PURSUIT, RAPTOR, SCEPTER, SHARPEN, VERDICT, and GLYPHOSATE. Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils. Do not make more than one application of ZIDUA to soybean in the spring.

Zidua PRO 4.09SC	4.5-6.0 fl oz			85 days	12 hours
(*saflufenacil*		0.017-0.022 lb	14		
+		+			
imazethapyr		0.047-0.062 lb	2		
+		+			
pyroxasulfone)		0.08-0.107 lb	15		

Comments: Apply ZIDUA PRO a minimum of 30 days before planting soybeans for coarse (sand, loamy sand, and sandy loam) soils with less than 2.0% organic matter. No preplant interval is required for coarse soils with greater than 2.0% organic matter and all medium/fine soils. Add MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). OPTILL may be tank mixed with CLARITY, PROWL, OUTLOOK, SHARPEN, ZIDUA, and GLYPHOSATE. Do not apply ZIDUA PRO with other Group 14 products, such as flumioxazin or sulfentrazone, as a tank mix or sequential application within 30 days of planting because crop injury may result. Group 14 herbicides labeled for postemergence application in soybean may be used 14 days after emergence. Do not apply more than 6.0 oz/A of ZIDUA PRO in a single application or cumulatively per cropping season. Do not apply more than 0.089 lb ai/A of saflufenacil per cropping season in soybean from all product sources. Do not apply more than 0.112 lb ai/A of pyroxasulfone on coarse soils per cropping season in soybean from all product sources. Do not graze or feed treated soybean forage, hay, or straw to livestock. **Rainfast interval = 1 hour.**

2,4-D Amine 3.8S (various)	1.0-2.0 pt	0.475-0.95 lb	4	---	48 hours
2,4-D LVE 3.8S					

Comments: Apply 15 (1.0 pt/A) to 30 days (2.0 pt/A) prior to planting soybeans. Use the higher rate on larger weeds. Do not use on a light, sandy soil, or where soil moisture is limiting weed growth. Very effective on cutleaf eveningprimrose, wild mustard, and Palmer amaranth (small). Can be tank-mixed with other burndown herbicides (see label). Do not exceed 2.0 pt/A (1.0 lb ae/A) per season. Do not use an ester formulation if sensitive crops, particularly cotton, tobacco, or vegetables, are within a mile of the application site.

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Conservation Tillage Soybean[1]

	Aim/ET[2]	Glyphosate[2]	Glyphosate + 2,4-D[2]	Glyphosate + Clarity[2]	Glyphosate + Leadoff[2]	Glyphosate + Sharpen[2]	Glyphosate + Valor SX[2]	Gramoxone[2]	Gramoxone + 2,4-D[2]	Gramoxone + Clarity[2]	Gramoxone + Valor SX[2]	Liberty[2]
barley, little	F	E	E	E	E	E	E	G	G	G	G	G
bluegrass, annual	G	F	F	F	E	E	E	G	G	G	G	P
buttercups	G	E	E	E	E	E	E	E	E	E	E	E
chickweed, common	G	F	G	GE	E	E	E	E	E	GE	E	E
clovers	P	PF	F	FG	G	E	F	G	G	GE	GE	F
cudweed	G	E	E	E	E	E	E	FG	FG	FG	FG	G
dandelion	P	P	E	E	E	G	G	N	E	GE	P	FG
dock, curly	P	PF	G	GE	F	F	G	F	FG	GE	P	G
eveningprimrose, cutleaf	GE	PF	E	GE	E	E	FG	F	E	GE	E	G
geranium, Carolina	GE	FG	E	E	E	E	E	GE	E	GE	E	GE
henbit/deadnettle	G	F	G	GE	E	E	E	G	GE	E	E	G
horseweed (marestail)	G	E	GE	E	GE	E	GE	F	GE	E	GE	GE
mustard, wild	G	FG	E	G	G	E	GE	FG	E	G	GE	GE
pansy, field	G	F	F	F	---	E	F	G	G	G	G	G
peanut, volunteer	F	F	F	G	P	GE	FG	P	F	GE	F	GE
pepperweed, Virginia	G	G	E	GE	E	E	G	G	GE	G	G	G
radish, wild	G	FG	GE	GE	G	E	GE	G	GE	GE	GE	GE
ryegrass, Italian	F	G	F	F	E	E	G	FG	FG	FG	FG	P
sorrel, red	F	E	E	E	G	G	E	E	E	E	E	PF
spurry, corn	G	GE	GE	GE	E	E	G	FG	G	G	G	---
swinecress	G	FG	G	G	E	E	FG	PF	FG	FG	PF	GE
vetch	GE	F	E	E	E	E	FG	G	GE	GE	GE	GE
wheat/rye cover crop	P	E	E	E	E	E	E	FG	F	F	G	F

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Herbicide rates for burndown are: ET/Aim at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ae/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; Leadoff at 1.5 oz/A; Sharpen at 1.0 oz/A; Gramoxone at 3.0 pt/A; Valor SX at 3.0 oz/A; and Liberty at 29 oz/A.

Glyphosate-Resistant Palmer Amaranth Programs-Soybean[1]

Palmer amaranth populations exist in South Carolina that are resistant to acetolactate synthase (ALS) inhibiting herbicides (i.e., Harmony, Classic, and Python) and dinitroaniline (yellow) herbicides (i.e., Prowl, Treflan, and Sonalan), and glyphosate (i.e., Roundup).

Currently, our PPO-inhibitors (i.e., Valor, Reflex, Flexstar, Ultra Blazer, and Cobra) do an excellent job of controlling ALS- and glyphosate-resistant Palmer amaranth biotypes, but our concern is that resistance may develop to the PPO-inhibitors from over-use because these herbicides are now used in all of our major row crops (corn, cotton, soybean, and peanuts) in South Carolina. Programs, such as Liberty-Link, will help preserve the usefulness of PPO-inhibitors for the future. The following table is designed to aid producers in managing and/or preventing glyphosate-resistant Palmer amaranth populations in soybean.

Seed Program	PRE	1st POST[2]	2nd POST
Roundup Ready	Valor SX[4] or Reflex[4]	glyphosate + Reflex[4] or glyphosate + Flexstar[4] or glyphosate + Ultra Blazer[4] or glyphosate + Cobra[4] or Sequence glyphosate + Warrant	*If needed[3]*
	Valor XLT[4] or Prefix[4] or Envive[4]		
	Dual Magnum, Intrro, Outlook, Prowl[5], Boundary, Fierce, Axiom, Zidua		
LibertyLink	Valor SX[4] or Reflex[4]	Liberty + Reflex[4] or Liberty + Flexstar[4] or Liberty + Ultra Blazer[4] or Liberty + Cobra[4] Liberty + Warrant	*If needed[3]*
	Valor XLT[4] or Prefix[4] or Envive[4]		
	Dual Magnum, Boundary, Axiom, Intrro, Outlook, Fierce, Zidua, Prowl[5]		
Conventional	Prowl[5], Valor SX[4], Valor XLT[4], or Reflex[4]	Reflex[4] or Ultra Blazer[4] or Cobra[4]	*If needed[3]*
	Canopy[6], Boundary, Axiom, Intrro, Dual Magnum, Outlook, Boundary, Fierce, Zidua, or Prowl[5]	Reflex[4] or Ultra Blazer[4] or Cobra[4]	Reflex[4] or Ultra Blazer[4] or Cobra[4]
	Prefix[4]	Reflex[4] or Ultra Blazer[4] or Cobra[4]	*If needed[3]*

[1]Glyphosate- and ALS-resistant Palmer amaranth is a very serious concern in South Carolina. An aggressive program is necessary to slow the spread of resistant biotypes and reduce selection pressure on susceptible populations.
[2]When applied in combination with glyphosate (Roundup Ready) or Liberty (LibertyLink), use 12 oz/A of Reflex or Flexstar, 1.0 pt/A of Ultra Blazer, 12.5 oz/A of Cobra. Applications should be made before Palmer amaranth exceeds 2 inches in height.
[3]A second postemergence application may not be needed. If Reflex or was applied earlier, use Ultra Blazer or Cobra for a second application (If Roundup Ready, include glyphosate if needed for additional weeds). Do not make a second application of Reflex. Reflex may be preferred because of residual control of Palmer amaranth.
[4]Valor, Valor XLT (Valor + Classic), Envive (Valor + Harmony + Classic), Cobra, Prefix (Reflex + Dual Magnum), Reflex, Flexstar, and Ultra Blazer have the same mode of action (PPO inhibitor). Therefore, do not make more than 1 application of these herbicides in a single season.
[5]If Palmer amaranth is not controlled by Prowl, Treflan, or Sonalan (DNA-resistance); use Dual Magnum, Outlook, or Intrro instead.
[6]When using Canopy, follow label for soil pH restrictions and soybean variety tolerance.

Weed Response to Soil Applied Herbicides for Soybean Weed Management[1]

	PPI[2]	PPI[2] *or* PRE[3]										
	Treflan/Sonalan	Authority MAXX	Authority MTZ	Axiom	Boundary	Canopy	Command	Dual Magnum	Intrro	Outlook	Prefix	Prowl
anoda, spurred	P	G	G	G	G	---	E	P	P	P	---	P
barnyardgrass	E	F	G	GE	GE	F	GE	GE	GE	GE	GE	E
beggarweed, Florida	P	G	G	G	G	G	---	P	F	P	P	P
bermudagrass	P	P	P	P	P	P	PF	P	P	P	P	P
citronmelon	P	---	---	F	F	F	G	P	P	P	---	P
cocklebur, common	P	F	G	F	F	GE	F	P	P	P	G	P
cowpea	P	P	P	P	F	F	P	P	P	P	P	P
crabgrass	E	F	F	E	E	G	E	E	E	E	E	E
crotalaria, showy	---	---	G	G	G	G	---	P	P	P	P	P
croton, tropic	P	---	---	GE	GE	G	G	P	P	P	FG	P
crowfootgrass	E	---	P	GE	GE	G	G	G	E	E	G	E
dayflower, Benghal	P	P	F	GE	GE	G	F	G	GE	G	E	P
eclipta		---										
goosegrass	E	F	FG	E	E	G	G	E	E	E	E	E
jimsonweed	P	G	G	GE	GE	G	FG	P	P	P	---	P
johnsongrass, seedling	E	F	F	GE	GE	P	F	F	F	F	PF	E
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	GE	G	GE	GE	GE	GE	GE	F	F	FG	E	GE
morningglory spp.	P	E	E	G	G	G	P	P	P	P	PF	FP
nutsedge, purple	P	G	G	P	P	P	P	P	P	P	---	P
nutsedge, yellow	P	G	G	P	P	F	P	FG	F	F	GE	P
panicum, fall	E	F	P	GE	GE	---	G	G	G	G	E	E
panicum, Texas	GE	F	P	P	P	G	FG	P	P	P	F	GE
pigweed spp.	GE	GE	GE	G	GE	GE	PF	G	G	G	E	FG
ALS-resistant	GE	GE	GE	G	GE	GE	PF	G	G	G	E	FG
DNA-resistant	P	GE	GE	G	GE	GE	PF	G	G	G	E	P
poinsettia, wild	P	---	F	GE	GE	G	P	P	P	P	E	P
pusley, Florida	E	---	---	E	E	E	FG	G	G	G	E	E
ragweed, common	P	F	GE	GE	GE	G	FG	P	PF	F	G	P
sandbur	E	F	---	GE	GE	P	F	G	G	FG	GE	E
senna, coffee	P	G	---	GE	GE	G	F	P	PF	P	P	P
sesbania, hemp	P	FG	P	GE	GE	GE	P	P	P	P	P	P
sicklepod	P	G	G	GE	GE	G	P	P	PF	P	P	P
sida, prickly	P	---	G	GE	GE	GE	G	F	G	P	---	P
signalgrass, broadleaf	G	F	F	GE	GE	FG	E	FG	FG	FG	G	G
smartweed, Pennsylvania	P	---	E	GE	G	G	E	P	P	P	F	P
starbur, bristly	P	---	---	GE	GE	G	---	P	F	P	E	P
velvetleaf	P	G	GE	GE	GE	G	E	P	P	P	---	P

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, 70% or less; --- = Insufficient Data.
[2]PPI = Preplant Incorporated
[3]PRE = Preemergence

Weed Response to Soil Applied Herbicides for Soybean Weed Management (cont.)[1]

	PRE[3] *or* PPI[2]					PRE[3]								
	Pursuit	**Python**	**Reflex**	**Scepter**	**Spartan**	**Envive**	**Fierce**	**Gangster**	**Linuron**	**Spartan Charge**	**Valor SX**	**Valor XLT**	**Zidua/Anthem**	**Warrant**
anoda, spurred	E	E	---	P	G	E	E	G	P	G	F	E	---	---
barnyardgrass	P	P	P	P	F	P	E	P	GE	P	P	P	E	E
beggarweed, Florida	P	FG	P	P	E	GE	GE	GE	G	G	GE	GE	GE	F
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P	P	P
citronmelon	PF	---	---	P	---	G	G	G	---	G	G	G	G	---
cocklebur, common	G	GE	G	E	GE	FG	FG	F	P	GE	P	FG	P	P
crabgrass	P	P	FG	F	FG	P	P	P	G	FG	P	P	GE	E
crowfootgrass	P	P	---	P	F	P	P	P	G	F	P	P	GE	E
cowpea	P	P	P	P	P	P	P	P	P	P	P	P	P	P
crotalaria, showy	---	---	---	---	---	G	G	G	G	---	G	G	G	P
croton, tropic	---	---	FG	P	---	E	E	GE	PF	---	G	E	G	P
dayflower, Benghal	FG	---	P	---	---	GE	GE	FG	---	---	F	G	FG	GE
eclipta	G	G	GE	---	GE	GE	GE	GE	G	---	GE	GE	G	G
goosegrass	P	P	---	PF	FG	P	P	P	G	FG	P	P	GE	E
jimsonweed	GE	P	---	FG	E	E	E	GE	F	E	G	GE	G	F
johnsongrass, seedling	P	P	---	P	F	P	P	P	P	F	P	P	GE	P
johnsongrass, rhizome	P	P	---	P	P	P	P	P	P	N	P	P	P	P
lambsquarters, common	F	E	E	G	E	E	E	GE	GE	E	GE	GE	G	FG
morningglory spp.	GE	FG	F	FG	E	G	G	GE	G	E	FG	G	F	P
nutsedge, purple	G	P	P	PF	E	P	P	P	P	E	P	F	P	P
nutsedge, yellow	FG	P	GE	FG	E	P	P	P	P	E	P	FG	P	F
panicum, fall	P	P	---	PF	FG	P	P	P	F	FG	P	P	GE	G
panicum, Texas	P	P	F	F	F	P	P	P	PF	F	P	P	F	F
pigweed spp.	E	GE	GE	E	E	E	E	E	G	E	E	E	E	GE
ALS-resistant	E	GE	GE	E	E	E	E	E	G	E	E	E	E	GE
DNA-resistant	E	GE	GE	E	E	E	E	E	G	E	E	E	E	GE
poinsettia, wild	E	G	GE	G	---	GE	GE	GE	---	---	FG	G	FG	G
pusley, Florida	GE	G	P	GE	FG	GE	GE	E	G	FG	GE	GE	G	GE
ragweed, common	P	FG	G	G	P	G	G	GE	G	P	GE	G	G	P
sandbur, field	P	P	---	---	PF	P	P	P	G	PF	P	P	GE	FG
senna, coffee	FG	F	P	FG	---	FG	FG	G	---	---	PF	FG	P	P
sesbania, hemp	P	P	P	P	GE	G	G	GE	F	GE	G	E	G	P
sicklepod	P	G	P	F	P	F	F	P	P	P	P	F	P	P
sida, prickly	E	E	GE	GE	P	E	E	GE	F	P	GE	E	GE	G
signalgrass, broadleaf	PF	P	FG	PF	F	P	P	P	P	F	P	P	FG	FG
smartweed, Pennsylvania	G	G	---	G	---	F	F	P	F	---	F	F	G	P
starbur, bristly	F	E	G	F	---	G	G	G	F	---	F	FG	F	P
velvetleaf	GE	GE	---	PF	GE	G	G	G	P	PF	F	G	G	G

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, 70% or less; --- = Insufficient Data.
[2]PPI = Preplant Incorporated
[3]PRE = Preemergence

Preplant Incorporated Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Anthem 2.15EC	5.0-10.0 fl oz			---	12 hours
(*pyroxasulfone*		0.082-0.163 lb	15		
+		+			
fluthiacet-methyl)		0.003-0.006 lb	14		
Comments: Incorporate ANTHEM into the upper (1-2 inches) soil surface up to 14 days before planting. Deeper incorporation may increase the potential for crop injury and may result in reduced weed control. Use appropriate equipment that provides uniform shallow incorporation, such as a field cultivator, harrow, rolling cultivator, or finishing disc.					
Authority MAXX 66DF	5.0-7.5 oz			---	12 hours
(*sulfentrazone*		0.194-0.290 lb	14		
+		+			
chlorimuron ethyl)		0.016-0.019 lb	2		
Comments: Uniformly incorporate AUTHORITY MAXX no deeper than the top 2 inches of the soil profile prior to planting soybeans. Improper incorporation can lead to erractic weed control and/or crop injury. Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MAXX to coarse sand soils with less than 1.0% orgranic matter. Do not follow AUTHORITY MAXX with a postemergence application of another chlorimuron-ethyl containing herbicide in the same cropping season. Do not tank mix AUTHORITY MAXX with organophosphate insecticides.					
Authority MTZ 45DF	12-16 oz			120 days	12 hours
(*sulfentrazone*		0.14-0.18 lb	14		
+		+			
metribuzin)		0.20-0.27 lb	5		
Comments: Incorporate uniformly within the top 2 inches of the soil profile. Do not incorporate deeper than 2 inches. Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MTZ to coarse soils with less than 1.0% organic matter. A lower rate (8 to 10 oz/A) of AUTHORITY MTZ is recommended in glyphosate-tolerant soybean production systems. Do not apply more than 33 oz of AUTHORITY MTZ per acre per season (12 months from the first application). AUTHORITY MTZ contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details.					
Axiom 68DF	7.0-13.0 oz			120 days	12 hours
(*flufenacet*		0.24-0.44 lb	15		
+		+			
metribuzin)		0.06-0.11 lb	5		
Comments: Incorporate uniformly within the top 1-2 inches of the soil zone up to 14 days before planting. Controls crabgrass, goosegrass, fall panicum, spurge, and purslane. Recommended tank mix partners for AXIOM include AUTHORITY BROADLEAF, CANOPY, COMMAND, FIRSTRATE, LINEX, PROWL, PYTHON, PURSUIT, SCEPTOR, SENCOR, SONALAN, or TREFLAN. AXIOM contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details. Do not apply more than 13 oz AXIOM per acre per season.					

Preplant Incorporated Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Broadaxe XC 7EC (*sulfentrazone* + *s-metolachlor*)	19-32 fl oz	0.104-0.175 lb + 0.94-1.58 lb			
Comments: Incorporate uniformly within the top 2 inches of the soil profile up to 14 days before planting. Control pigweed, morningglories, fall panicum, broadleaf signalgrass, and lambsquarters. Do not incorporate deeper than 2 inches. Use rate is dependent on soil texture and organic matter content, consult label for more details. Do not apply BROADAXE XC to soils classified as sand which have less than 1.0% organic matter. Do not apply more than 38.7 fl. oz per acre of BROADAXE XC per crop year. Do not graze or feed treated soybean forage, hay or straw to livestock for 30 days after treatment. Do not apply after crop seed germination.					
Boundary 6.5EC (*s-metolachlor* + *metribuzin*)	1.2-2.1 pt	0.79-1.38 lb + 0.19-0.33 lb	15 + 5	160 days	12 hours
Comments: Incorporate uniformly within the top 2 inches of the soil zone. Use rate is dependent on soil type, check label for details. Not recommended for use on sands with less than 1.0% organic matter. Can be tank mixed with PYTHON, SCEPTER, CANOPY, COMMAND, or PROWL. BOUNDARY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not use BOUNDARY in conjunction with soil-applied organophosphate insecticides.					
Canopy 75DF (*metribuzin* + *chlorimuron*)	6.0-8.0 oz	0.24-0.32 lb + 0.04-0.05 lb	5 + 2	---	12 hours
Comments: Incorporate to a depth of 1 to 2 inches in the soil zone. Tank mix with TREFLAN, PROWL, or SONALAN for improved grass control. Use lower rate on sandy soils. CANOPY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not tank mix CANOPY with soil-applied organophosphate insecticides. Do not apply CANOPY within 14 days before or after an application of an organophosphate insecticide as severe crop injury may occur.					
Dual Magnum 7.62EC (*s-metolachlor*)	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours
Comments: Incorporate to a depth of 1 to 2 inches in the soil zone. Excellent control of annual grasses and small seeded broadleaves. Tank mix partners include LOROX, CANOPY, SCEPTER, PURSUIT, SONOLAN, or SENCOR.					
FirstRate 84WDG (*chloransulam-methyl*)	0.3-0.6 oz	0.016-0.032 lb	2	65 days	12 hours
Comments: Incorporate to depth of 1 to 3 inches of the final seedbed using equipment that provides thorough soil mixing. Do not apply FIRSTRATE earlier than 4 weeks before planting (best results occur when done 2 weeks before planting).					

Preplant Incorporated Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Intrro 4EC (*alachlor*)	2.0-2.75 qt	2.0-2.75 lb	15	70 days	12 hours
Micro-Tech 4ME					

Comments: MICRO-TECH and INTRRO are RESTRICTED USE PESTICIDES. Incorporate to a depth of 1-2 inches deep in the soil zone. Excellent control of annual grasses and small seeded broadleaves. Performance on Palmer amaranth is slightly better than PROWL. Use a minimum of 3 qt/A for control of nutsedge on coarse textured soils. Consult label for tank mix partners. Do make more than one application per year or exceed 3 qt/A per season.

Prowl 3.3EC (*pendimethalin*)	1.8-2.1 pt	0.74-0.87 lb	3	21 days	24 hours
Prowl H_2O 3.8EC	1.5-2.1 pt	0.71-1.0 lb			

Comments: Use to control annual grasses, seedling johnsongrass and Florida pusley. Incorporate in the 2 to 3 inches of the seedbed within in 7 days of application; immediate incorporation suggested. Mechanical incorporation is not required if rain event of 0.5 inch or greater occurs within 7 days of application. Do not exceed 2.1 pt/A per application.

Pursuit 70DF (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 oz				

Comments: Incorporate to a depth of 2 to 3 inches in the soil zone. Controls annual broadleaf weeds and suppresses nutsedge. Tank mix with PROWL or TREFLAN for improved annual grasses control. PURSUIT should only be applied once per season to soybeans. Do not apply CLASSIC, CANOPY, or SCEPTER to field previously treated with PURSUIT. Do not tank mix with COMMAND.

Python 80WDG (*flumetsulam*)	0.8-1.14 oz	0.04-0.057 lb	2	85 days	12 hours

Comments: Incorporate to a depth of 2 to 3 inches deep in the soil zone. Controls several annual broadleaf weeds including lambsquarters, pigweeds, and prickly sida; generally, provides control of light to moderate infestations of Florida beggarweed, common ragweed, and sicklepod. Marginal control of annual morningglory. Tank mix with PROWL or TREFLAN for improved annual grass control.

Scepter 70DF (*imazaquin*)	2.8 oz	0.12 lb	2	90 days	12 hours

Comments: Apply and incorporate 1 to 2 inches deep in the soil zone. Controls Florida beggarweed, annual morningglory, *glyphosate-resistant Palmer amaranth*, and Florida pusley. Tank mix with PROWL or TREFLAN for grass control. Do not apply CLASSIC, CANOPY, SQUADRON, SYNCHRONY, PURSUIT PLUS, or PURSUIT to field previously treated with SCEPTER. Do not plant cotton within 18 months of application.

Sonalan HFP (*ethalfuralin*)	1.5-2.5 pt	0.56-0.94 lb	3	---	24 hours
Sonalan 10G	5.5-9.5 lb				

Comments: Apply SONALAN 2.0 to 3.0 pt/A for rhizome johnsongrass control. For better pigweed control, use 1.5 pt/A on coarse-textured soils and 2.0 pt/A on medium-textured soils. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Do not use SCEPTER as a tank mix or as a follow-up postemergence application to SONALAN. Soybean should be planted no more than 2 inches deep after adverse weather conditions have occurred since application or crop injury may occur.

Preplant Incorporated Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Spartan 4F (*sulfentrazone*)	4.5-8.0 fl oz	0.14-0.25 lb	14	None	12 hours
Comments: Apply SPARTAN 4F to the soil surface and incorporate to a depth of 2 inches. Do not incorporate deeper than 2 inches. Improper soil incorporation may result in erratic weed control and/or crop injury. Excellent control of morningglory, pigweed, lambsquarters, and yellow nutsedge. Tank mix with PROWL, TREFLAN, or DUAL MAGNUM for improved annual grass control. Do not apply more than 12 fl oz/A of SPARTAN per 12 month period. Do not apply SPARTAN to soils classified as sands with less than 1.0% organic matter.					
Treflan 4EC (*trifluralin*)	1.0-1.5 pt	0.5-0.75 lb	3	60 days	12 hours
Treflan TR-10G	5.0-7.5 lb				
Comments: Controls annual grasses and some small-seeded broadleaf weeds, seedling johnsongrass. Use 2.0 to 3.0 pt/A for rhizome johnsongrass control. For enhanced Palmer amaranth control, use the 1.5 pt/A rate. Incorporate TREFLAN to a depth of 2 to 3 inches within 24 hours after application. Cross disk for best results. Soybean should not be planted after adverse weather conditions have occurred since application or crop injury may occur.					
Zidua 85WG (*pyroxasulfone*)	1.5-2.1 oz	0.080-0.112 lb	15	None	12 hours
Comments: Apply ZIDUA incorporated up to 14 days prior to planting soybeans. For enhanced burndown and/or residual control of weeds in reduced tillage fields, tank mix with PROWL H2O, PURSUIT, and SCEPTER. Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils. Do not make more than one application of ZIDUA to soybean in the spring.					

Preemergence Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Anthem 2.15EC (*pyroxasulfone* + *fluthiacet-methyl*)	5.0-9.5 fl oz	0.082-0.155 lb + 0.003-0.005 lb	15 14	---	12 hours
Comments: Apply ANTHEM from planting through the third trifoliate stage (V3). Under high moisture conditions the crop may experience some temporary crop response. The crop will rapidly outgrow these effects and develop normally with no reduction in yield. On coarse textured soils (with less than 3% organic matter), do not apply more than 6.8 oz/A of ANTHEM per cropping season. On other soil types, do not apply more than 11.4 oz/A of ANTHEM per cropping season.					
Authority MAXX 66DF (*sulfentrazone* + *chlorimuron ethyl*)	5.0-7.5 oz	0.194-0.290 lb + 0.016-0.019 lb	14 2	---	12 hours
Comments: Apply AUTHORITY MAXX at planting or within 3 days of planting, but before soybean cracking (emergence). The seed furrow should be completely closed and seed covered before any application of AUTHORITY MAXX. Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MAXX to soils classified as sand which have less than 1.0% orgranic matter. Do not follow AUTHORITY MAXX with a postemergence application of another chlorimuron-ethyl containing herbicide in the same cropping season. Do not tank mix AUTHORITY MAXX with organophosphate insecticides.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Authority MTZ 45DF	12-16 oz			120 days	12 hours
(*sulfentrazone*		0.14-0.18 lb	14		
+		+			
metribuzin)		0.20-0.27 lb	5		
Comments: Apply AUTHORITY MTZ at planting or within 3 days of planting, but before soybean cracking (emergence). Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MTZ to soils classified as sand which have less than 1.0% orgranic matter. A lower rate (8 to 10 oz/A) of AUTHORITY MTZ is recommended in glyphosate- or glufosinate-tolerant soybean production systems. Do not apply more than 20 oz of AUTHORITY MTZ per acre per season (12 months from the first application). AUTHORITY MTZ contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details.					
Axiom 68DF	7.0-13.0 oz			120 days	12 hours
(*flufenacet*		0.24-0.44 lb	15		
+		+			
metribuzin)		0.06-0.11 lb	5		
Comments: Controls crabgrass, goosegrass, fall panicum, spurge, and purslane. Recommended tank mix partners include AUTHORITY BROADLEAF, CANOPY, COMMAND, FIRSTRATE, LINEX, PROWL, PYTHON, PURSUIT, SCEPTOR, SENCOR, or SONALAN, or TREFLAN. AXIOM contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details. Do not apply more than 13 oz AXIOM per acre per season.					
Boundary 6.5EC	1.2-2.1 pt			40 days	12 hours
(*s-metolachlor*		0.79-1.38 lb	15		
+		+			
metribuzin)		0.19-0.33 lb	5		
Comments: Controls Florida pusley, crabgrass, crowfootgrass, pigweed spp., and bristly starbur. Use rate is dependent on soil type, check label for details. BOUNDARY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not use BOUNDARY in conjunction with soil-applied organophosphate insecticides. Soybeans may be injured by preemergence applications of BOUNDARY if they are not planted at least 1.5 inches deep. Do not use BOUNDARY on soils with less than 0.5% organic matter.					
Broadaxe XC 7EC	19-32 fl oz			30 days	24 hours
(*sulfentrazone*		0.104-0.175 lb	14		
+		+			
s-metolachlor)		0.94-1.58 lb	15		
Comments: Apply BROADAXE XC to the soil surface prior to planting, at planting, or up to 3 days after planting Controls pigweed, morningglories, fall panicum, broadleaf signalgrass, and lambsquarters. Use rate is dependent on soil texture and organic matter content, consult label for more details. Do not apply BROADAXE XC to soils classified as sand which have less than 1.0% organic matter. Do not apply more than 38.7 fl. oz per acre of BROADAXE XC per crop year. Do not graze or feed treated soybean forage, hay or straw to livestock for 30 days after treatment. Do not apply after crop seed germination.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Canopy 75DF	6.0-8.0 oz			---	12 hours
(*metribuzin*		0.24-0.32 lb	5		
+		+			
chlorimuron)		0.04-0.05 lb	2		

Comments: Controls *glyphosate-resistant Palmer amaranth*, prickly sida, and wild mustard, and several other broadleaf weeds. Tank mix with DUAL MAGNUM, PROWL, or INTRRO for improved grass control. Use lower rate on sandy soils. CANOPY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not tank mix CANOPY with soil-applied organophosphate insecticides. Do not apply CANOPY within 14 days before or after an application of an organophosphate insecticide as severe crop injury may occur.

Command 3ME	2.0-3.33 pt			9 days	12 hours
(*clomazone*)		0.75-1.25 lb	13		

Comments: Controls crabgrass, fall panicum, Texas panicum, velvetleaf, spurred anoda, annual morningglory, and prickly sida. Provides only marginal suppression of most other broadleaf weeds (Palmer amaranth). May be tank mix with CANOPY, DUAL, INTRRO, LOROX, PROWL, PURSUIT, or SCEPTER to enhance weed control spectrum. Do not apply in the air or within 300 ft of housing developments, commercial fruit, vegetable, or nut production, or commercial ornamental nurseries or greenhouses.

Dual Magnum 7.62EC	1.0-1.33 pt			100 days	24 hours
(*s-metolachlor*)		0.95-1.27 lb	15		

Comments: Excellent control of annual grasses and small seeded broadleaves. Poor activity on large-seeded broadleaves like sicklepod and morningglory. Tank mix with LOROX, CANOPY, COMMAND, SCEPTER, PURSUIT, or SENCOR to improve spectrum of weed control.

Envive 41.3DF	2.5-4.0 oz			---	12 hours
(*chlorimuron*		0.014-0.023 lb	2		
+		+			
flumioxazin		0.046-0.073 lb	14		
+		+			
thifensulfuron)		0.005-0.007 lb	2		

Comments: ENVIVE controls tropic croton, *ALS- and glyphosate-resistant Palmer amaranth*, and Florida beggarweed. A single postemergence application in soybeans of CLASSIC or SYNCHRONY XP at up to 0.75 oz/A is allowed after preemergence application of ENVIVE. For grass weeds, tank mix with PROWL or COMMAND. Do not apply ENVIVE 14 days before or after a soil organophosate application unless soybean variety is STS or STS/RR. Do not irrigate soybean treated with ENVIVE during cracking. Do not tank mix ENVIVE with acetochlor (WARRANT), alachlor (MICRO-TECH), flufenacet (AXIOM, DOMAIN), or dimethenamid-p (OUTLOOK) products within 14 days of planting soybeans, unless soybeans are planted under no-till or minimum tillage conditions on wheat stubble or no-till field corn stubble. *Be sure clean-out ENVIVE from the sprayer after each day's use and before spraying any other crop*.

Resistance Management: *Make only* ***<u>one</u>*** *application of a group 14 containing herbicide such as fomesafen (REFLEX, PREFIX, FLEXSTAR GT) or flumioxazin (VALOR) per growing season.*

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Fierce 76DF (*flumioxazin* + *pyroxasulfone*)	3.0-3.75 oz	0.063-0.079 lb + 0.080-0.100 lb	14 15	---	12 hours
Comments: Apply FIERCE within 3 days of planting and prior to soybean emergence. Do not apply more than 3.75 oz/A of FIERCE during a single growing season. Tank mix partners for additional grass and broadleaf weed control include CHLORIMURON, COMMAND, GANGSTER, METRIBUZIN, FIRSTRATE, LOROX, PURSUIT PLUS, PENDIMETHALIN, PYTHON, SCEPTER, VALOR, and VALOR XLT. Spray equipment, including mixing vessels and nurse tanks, must be cleaned each day following FIERCE application*; do not let FIERCE sit overnight in the tank*.					
FirstRate 84WDG (*chloransulam-methyl*)	0.3-0.6 oz	0.016-0.032 lb	2	65 days	12 hours
Comments: Apply FIRSTRATE after planting but prior to crop or weed emergence. Controls bristly starbur, annual morningglory, common ragweed, and sicklepod. Weak on Palmer amaranth. FIRSTRATE may be tank mixed with other herbicides labeled for preemergence use in soybeans.					
Gangster V 51 WDG (*flumioxazin*) + Gangster FR 84DF (*chloransulam*)	1.5-3.0 oz + 0.3-0.6 oz	0.048-0.096 lb + 0.016-0.032 lb	14 2	---	12 hours
Comments: Apply GANGSTER at planting or within 3 days of planting. Controls Florida beggarweed, *ALS- and glyphosate-resistant Palmer amaranth*, and annual morningglories. For additional preemergence grass weed control, tank mix with PROWL or COMMAND. Do not apply more than 3.0 oz/A of GANGSTER V and 0.6 oz/A of GANGSTER FR per growing season. Do not irrigate soybean treated with GANGSTER during cracking. *Be sure to follow the clean-out instructions for removing GANGSTER from the sprayer after each day's use; do not let GANGSTER sit overnight in the tank*.					
Intrro 4EC (*alachlor*)	2.0-2.75 qt	2.0-2.75 lb	15	70 days	12 hours
Micro-Tech 4ME					
Comments: MICRO-TECH and INTRRO are RESTRICTED USE PESTICIDES. Excellent control of annual grasses and small seeded broadleaves. Performance on Palmer amaranth slightly better than PROWL. Consult label for tank mix partners. Do make more than one application per year or exceed 3 qt/A per season.					
Lorox 50DF (*linuron*)	1.0-2.0 lb	0.5-1.0 lb	7	57 days	24 hours
Linex 4L	1.0-2.0 pt				
Comments: Controls Florida beggarweed, crabgrass, common ragweed, and pigweed. Rate is dependent on soil type, consult label for details. For broad spectrum weed control, labeled tank mix partners include DUAL MAGNUM, SYNCHRONY XP, CLASSIC, PROWL, BOUNDARY, or GANGSTER. Plant soybean at least 1" deep to avoid potential crop injury.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Outlook 6EC (*dimethenamid-p*)	12-18 oz	0.56-0.84 lb	15	---	12 hours
Comments: Controls small seeded annual grasseses and broadleaves. Tank mix with LOROX, COMMAND, FLEXSTAR, CANOPY, SCEPTER, FIRSTRATE, or SENCOR to improve spectrum of weed control.					
Prefix 5.29EC	2.0 pt			80 days	24 hours
(*s-metolachlor* + *fomesafen*)		1.09 lb + 0.24 lb	15 + 14		
Comments: Excellent control of *glyphosate- and ALS-resistant Palmer amaranth*, bristly starbur, and crabgrass. Apply during or immediately after planting before soybeans or weeds emerge. Dry weather after application may reduce PREFIX effectiveness. **Resistance Management:** *Make only **one** application of a group 14 containing herbicide such as fomesafen (REFLEX, PREFIX, FLEXSTAR GT) or flumioxazin (VALOR) per growing season.*					
Prowl 3.3EC (*pendimethalin*)	1.8-2.4 pt	0.74-0.99 lb	3	21 days	24 hours
Prowl H_2O 3.8EC	1.5-2.0 pt	0.71-0.95 lb			
Comments: Controls annual grasses and small-seeded broadleaf weeds. Apply at planting or up to 2 days after planting. If your field has a history of poor Palmer amaranth control with yellow herbicides, consider tank mixing with BOUNDARY or VALOR. Good control of Florida pusley. Effective for Brazil pusley emerging from seed but not effective against plants growing from root stock. Do not exceed one application per crop season at the highest rate per acre for any given soil type.					
Pursuit 70DF (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 oz				
Comments: Controls annual broadleaf weeds and provides some nutsedge suppression. Tank mix with PROWL, DUAL MAGNUM, or OUTLOOK for improved annual grasses control. PURSUIT should only be applied once per season to soybeans. Do not apply CLASSIC, CANOPY, or SCEPTER to field previously treated with PURSUIT. Do not tank mix with COMMAND.					
Python 80WDG (*flumetsulam*)	0.89-1.14 oz	0.045-0.057 lb	2	85 days	12 hours
Comments: Controls several annual broadleaf weeds including lambsquarters, pigweeds, and prickly sida; generally provides control of light to moderate infestations of Florida beggarweed, common ragweed, and sicklepod. Marginal control of annual morningglory. Tank mix with PROWL, OUTLOOK, or DUAL MAGNUM for improved annual grass control.					
Reflex 2EC (*fomesafen*)	1.0-1.5 pt	0.25-0.375 lb	14	70 days	24 hours
Comments: Controls *glyphosate- and ALS-resistant Palmer amaranth*, annual morningglory, bristly starbur, and other broadleaf weeds. Tank mix PROWL, BOUNDARY, or DUAL MAGNUM for increased grass activity. Do not exceed 1.5 pt/A (0.375 lb ai/A) of REFLEX per calendar year. **Resistance Management:** *Make only **one** application of a group 14 containing herbicide such as fomesafen (REFLEX, PREFIX, FLEXSTAR GT) or flumioxazin (VALOR) per growing season.*					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Rowel FX 40.3WDG (*flumioxazin* + *chlorimuron-ethyl*)	3.0-5.0 oz	 0.139-0.234 lb + 0.048-0.080 lb	 14 2	---	12 hours
Comments: Controls annual morningglory, hemp sesbania, sicklepod, smartweed, glyphosate-resistant Palmer amaranth. Tank mix with *pendimethalin* or COMMAND for enhanced grass activity. On soils with a composite pH of 7.0 or less, apply 4.0 to 5.0 oz/A of ROWEL FX. Do not graze treated fields or feed treated forage or hay to livestock.					
Scepter 70DF (*imazaquin*)	2.8 oz	 0.12 lb	 2	90 days	12 hours
Comments: Controls Florida beggarweed, annual morningglory, *glyphosate-resistant Palmer amaranth*, and Florida pusley. Tank mix with PROWL, TREFLAN, OUTLOOK, or other labeled herbicides for grass control. Do not apply CLASSIC, CANOPY, SQUADRON, SYNCHRONY, PURSUIT PLUS, or PURSUIT to field previously treated with SCEPTER. Do not plant cotton within 18 months of application.					
Sonic 70DG (*chloransulam-methyl* + *sulfentrazone*)	3.0-5.0 oz	 0.015-0.025 lb + 0.116-0.193 lb	 2 14	65 days	12 hours
Comments: Apply SONIC to the soil surface prior to planting, at planting, or up to 3 days after planting. Properly closed seed furrow are necessary when applying at planting. Do not apply SONIC to soils classified as sands containing less than 1% organic matter. Do not feed treated soybean forage or soybean hay to livestock. Do not make more than one soil application per crop year. Do not apply more than 8 oz of SONIC per acre per season.					
Spartan 4F (*sulfentrazone*)	4.5-8.0 fl oz	 0.14-0.25 lb	 14	None	12 hours
Comments: Apply SPARTAN 4F to the soil surface prior to planting or up to 3 days after planting. Do not apply SPARTAN after 3 days because injury may occur as seeds are germinating. Excellent control of morningglory, pigweed, lambsquarters, and yellow nutsedge. Tank mix with PROWL, OUTLOOK, or DUAL MAGNUM for improved annual grass control. Do not apply more than 12 fl oz/A of SPARTAN per 12-month period. Do not apply SPARTAN to soils classified as sands with less than 1.0% organic matter.					
Spartan Charge 3.5S (*carfentrazone* + *sulfentrazone*)	5.5-8.5 fl oz	 0.015-0.026 lb + 0.14-0.21 lb	 14 14	None	12 hours
Comments: Apply SPARTAN CHARGE to the soil surface prior to planting or up to 3 days after planting. Do not apply SPARTAN CHARGE after 3 days because injury may occur as seeds are germinating. SPARTAN CHARGE will provide postemergence activity on weeds (less than 3 inches in height) present at the time of application. Sprayer calibration and good agitation are essential with application of SPRATAN CHARGE. Excellent control of morningglory, pigweeds, lambsquarters, and yellow/purple nutsedge. Tank mix with PROWL, OUTLOOK, or DUAL MAGNUM for improved annual grass control. Do not apply more than 8.5 fl oz/A of SPARTAN CHARGE per 12-month period. Do not apply SPARTAN CHARGE to soils classified as sands with less than 1.0% organic matter.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Surveil FR Co-Pack	0.3-0.6 oz			65 days	12 hours
(*chloransulam methyl*)		0.016-0.32 lb	2		
+	+	+			
Surveil V Co-Pack	1.5-3.0 oz				
(*flumioxazin*)		0.048-0.096 lb	14		

Comments: Apply SURVEIL FR + V CO-PACK to the soil surface prior to planting, at planting, or up to 3 days after planting. Application after soybeans have begun to crack or are emerged will result in severe crop injury. Do not tank mix SURVEIL CO-PACK with WARRANT, MICRO-TECH, AXIOM, DOMAIN, BOUNDARY, DUAL MAGNUM, DUAL II MAGNUM, FRONTIER, or OUTLOOK within 14 days of planting soybeans unless soybeans are planted under no-till or minimum tillage conditions on wheat stubble or no-till field corn stubble. For additional spectrum of weed control, SURVEIL FR + V CO-PACK may be tank mixed with METRIBUZIN, LOROX, PROWL, or COMMAND. Do not irrigate when soybeans are cracking. Do not apply more than 3.0 oz of SURVEIL V or 0.6 oz of SURVEIL FR per acre during a growing season. Spray equipment must be cleaned each day following SURVEIL CO-PACK application.

Trivence 61.3 WDG	8.0-10.0 oz			None	12 hours
(*chlorimuron-ethyl*		0.020-0.024 lb	2		
+		+			
flumioxazin		0.064-0.080 lb	14		
+		+			
metribuzin)		0.223-0.279 lb	5		

Comments: Apply TRIVENCE to the soil surface prior to planting, at planting, or up to 3 days after planting. Do not apply more than 8.7 oz/A of TRIVENCE on coarse textured soils. Do not exceed 9.0 oz/A of TRIVENCE on soils with a composite pH of 7.0 or greater. Controls several broadleaf weeds including *ALS-and glyphosate-resistant Palmer amaranth*, prickly sida, and tropic croton. For additional weed control spectrum, TRIVENCE may be tank mixed with COMMAND, *linuron*, *metribuzin*, *pendimethalin*, or *pyroxasulfone*. Do not tank mix TRIVENCE with *metolachlor* (DUAL MAGNUM, BOUNDARY), *dimethenamid-p* (Outlook), *alachlor* (INTRRO), or *flufenacet* (AXIOM, DOMAIN) or soybean injury may occur especially when application is followed by prolonged periods of cool, wet weather. Do not apply TRIVENCE within 14 days before or after an application of an organophosphate insecticide on any soybean variety that is not STS or STS/RR as severe crop injury may occur. Do not irrigate soybeans during cracking. *Be sure to follow the clean-out instructions for removing TRIVENCE from the sprayer after each day's use; do not let spray solution sit overnight in the tank*.

Valor SX 51WDG	2.0-3.0 oz			60 days	12 hours
(*flumioxazin*)		0.064-0.096 lb	14		
Rowel 51WDG					
Valor EZ 4SC	2.0-3.0 fl oz				

Comments: Apply VALOR/ROWEL to soybean prior to planting, at planting, or up to 3 days after planting. Controls several broadleaf weeds including *ALS-and glyphosate-resistant Palmer amaranth*, prickly sida, and tropic croton. For additional residual grass and broadleaf control, tank mix with COMMAND, FIRSTRATE, LOROX, PURSUIT PLUS, PYTHON, *pendimethalin*, SQUADRON, or SCEPTER. Do not apply more than 3 oz/A of VALOR/ROWEL during a single growing season. Do not tank mix VALOR/ROWEL with *metolachlor* (DUAL MAGNUM, BOUNDARY), *dimethenamid-p* (Outlook), *alachlor* (INTRRO), or *flufenacet* (AXIOM, DOMAIN) or soybean injury may occur especially when application is followed by prolonged periods of cool, wet weather. Do not irrigate soybeans during cracking. *Be sure to follow the clean-out instructions for removing VALOR/ROWEL from the sprayer after each day's use; do not let VALOR/ROWEL sit overnight in the tank*.

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Valor XLT 40.3WDG	3.0-5.0 oz			---	12 hours
(*flumioxazin*		0.057-0.094 lb	14		
+		+			
chlorimuron)		0.019-0.032 lb	2		

Comments: Controls several broadleaf weeds including *ALS-and glyphosate-resistant Palmer amaranth*, prickly sida, and tropic croton. For enhanced residual control of broadleaf weeds in reduced tillage fields, tank mix with DUAL, METRIBUZIN, LINURON, or WARRANT. Areas (i.e., in the crop rows) that are excessively disturbed by the planting operation may see diminished weed control. Do not apply VALOR XLT within 14 days before or after an application of an organophosphate insecticide on any soybean variety that is not STS or STS/RR. For enhanced grass activity, tank mix PROWL or COMMAND. Do not tank mix VALOR XLT with metolachlor (DUAL MAGNUM, BOUNDARY), dimethenamid-p (Outlook), alachlor (INTRRO), or flufenacet (AXIOM, DOMAIN) or soybean injury may occur especially when application is followed by prolonged periods of cool, wet weather. Do not apply more than 5 oz/A of VALOR XLT per growing season. Do not use VALOR XLT on soils with a composite pH of greater than 7.6. *Be sure to follow the clean-out instructions for removing VALOR XLT from the sprayer after each day's use; do not let VALOR XLT sit overnight in the tank*.

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Warrant 3.0ME	1.25-2.0 qt			---	12 hours
(*acetochlor*)		0.94-1.5 lb	15		

Comments: Provides residual control of small seeded broadleaves (including glyphosate-resistant Palmer amaranth) and grasses. Apply after planting but before weeds germinate. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control weeds that have germinated since planting. Environmental conditions that follow application of WARRANT including cold, wet soils or water logged conditions from excessive rain may result in crop injury. Do not apply *acetochlor* within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well.

Warrant Ultra 3.45ME	48 fl oz			45 days	12 hours
(*acetochlor*		1.07 lb	15		
+		+			
fomesafen)		0.24 lb	14		

Comments: Apply WARRANT ULTRA after planting soybeans but before weeds germinate. Environmental conditions that follow application of WARRANT ULTRA including cold, wet soils or water logged conditions from excessive rain may result in crop injury. Do not apply *acetochlor* within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well.

Zidua 85WG	1.5-2.1 oz			None	12 hours
(*pyroxasulfone*)		0.080-0.112 lb	15		

Comments: Apply ZIDUA to the soil surface after planting and before the crop emergence. Soybean seed must be planted at a minimum of 1.0 inch deep. The use of ZIDUA may result in temporary growth suppression in soybean if extreme conditions of high rainfall and extended periods of water saturated soil occur duing soybean germination or early seedling development. ZIDUA may be tank mixed with OUTLOOK, PROWL H2O, PURSUIT, VERDICT. Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils. Do not make more than one application of ZIDUA to soybean in the spring.

Weed Response to Postemergence Herbicides for Soybean Weed Management[1]

	Aim/ET	Assure II	Basagran	Cadet	Classic	Cobra	FirstRate	Flexstar	Flexstar GT[2]	Fusilade DX	Fusion	Glyphosate[2]	Harmony GT /SG
anoda, spurred	F	P	G	---	F	F	F	F	E	P	P	GE	P
barnyardgrass	G	GE	F	G	P	P	P	G	E	E	E	E	---
beggarweed, Florida	F	P	P	G	E	P	FG	P	G	P	P	G	---
bermudagrass	P	GE	P	P	P	P	P	P	G	G	G	G	P
citronmelon	P	P	P	P	---	G	---	---	G	P	P	G	P
cocklebur, common	GE	P	E	---	E	GE	E	E	E	P	P	E	FG
cowpea	P	P	P	P	G	P	P	F	FG	P	P	G	P
crabgrass	P	E	P	P	P	P	P	P	E	G	GE	E	P
crotalaria, showy	F	P	P	F	---	E	---	GE	GE	P	P	GE	---
croton, tropic	G	P	P	---	P	G	P	G	E	P	P	GE	P
crowfootgrass	P	E	P	P	P	P	P	P	E	FG	GE	E	P
dayflower, Benghal	---	P	---	---	F	---	---	----	---	P	P	F	---
eclipta	FG	P	FG	FG	---	GE	---	GE	E	P	P	E	---
goosegrass	P	E	P	P	P	P	P	P	E	G	GE	E	P
jimsonweed	GE	P	E	---	GE	GE	E	E	E	P	P	E	F
johnsongrass, seedling	P	E	P	P	P	P	P	P	E	GE	GE	E	P
johnsongrass, rhizome	P	G	P	P	P	P	P	P	E	GE	G	E	P
lambsquarters, common	P	P	F	---	P	P	P	F	E	P	P	E	GE
morningglory spp.	G	P	F	G	G	G	E	GE	GE	P	P	FG	FG
nutsedge, purple	P	P	P	P	PF	P	PF	P	G	P	P	G	P
nutsedge, yellow	P	P	G	P	G	P	PF	F	FG	P	P	FG	P
panicum, fall	P	E	P	P	P	P	P	P	E	GE	GE	E	P
panicum, Texas	P	E	P	P	P	P	P	P	E	G	GE	E	P
pigweed spp.	G	P	P	G	F	G	P	G	E	P	P	E	GE
ALS-resistant	G	P	P	G	P	G	P	G	E	P	P	E	P
glyphosate-resistant	G	P	P	G	F	G	P	G	E	P	P	P	GE
poinsettia, wild	GE	P	P	---	P	GE	GE	---	GE	P	P	GE	---
purslane, common	G	P	P	G	---	E	---	---	G	P	P	G	---
pusley, Florida	G	P	P	---	F	G	G	---	G	P	P	FG	F
ragweed, common	E	P	F	---	G	E	E	GE	E	P	P	GE	F
redweed (chocolateweed)	G	P	GE	G	F	F	---	---	G	P	P	G	---
sandbur	P	E	P	P	P	PF	P	P	E	G	GE	E	P
senna, coffee	FG	P	G	---	P	FG	---	---	FG	P	P	GE	G
sesbania, hemp	G	P	P	G	E	G	PF	E	E	P	P	PF	F
sicklepod	P	P	P	G	G	P	F	P	E	P	P	E	P
sida, prickly	G	P	G	---	P	G	P	F	G	P	P	G	P
signalgrass, broadleaf	P	E	P	P	P	PF	P	P	E	G	E	E	P
smartweed, Pennsylvania	G	E	GE	G	G	GE	---	G	G	P	P	G	GE
spurge	FG	P	F	FG	---	GE	---	G	G	P	P	G	---
starbur, bristly	GE	P	G	---	G	GE	E	---	E	P	P	GE	P
velvetleaf	G	P	G	---	GE	G	G	F	E	P	P	GE	G
vol. corn	P	G	P	P	P	F	P	F	F	GE	GE	E	P
RR hybrids	P	G	P	P	P	F	P	F	F	GE	GE	P	P
RR/LL hybrids	P	G	P	P	P	F	P	F	F	GE	GE	P	P

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Use only on glyphosate-tolerant (Roundy Ready, Roundup Ready 2) soybean varieties.

Weed Response to Postemergence Herbicides for Soybean Weed Management (cont.)[1]

	Liberty[2]	Outlook[3]	Poast/ Plus	Pursuit	Raptor	Reflex	Resource	Scepter	Select/ MAX	Sequence[4]	Storm	Ultra Blazer	Xtendimax[5]	2,4-DB
anoda, spurred	P	P	P	F	F	P	P	P	P	GE	F	P	G	P
barnyardgrass	G	GE	GE	G	F	F	G	---	GE	E	G	G	P	P
beggardweed, Florida	GE	F	P	P	---	P	---	P	P	G	P	P	G	P
bermudagrass	P	P	FG	P	P	P	P	P	G	G	P	P	P	P
citronmelon	G	P	P	P	P	---	---	---	P	G	G	F	G	P
cocklebur, common	E	P	P	E	E	G	G	E	P	E	GE	G	E	GE
cowpea	G	P	P	P	P	F	G	P	P	FG	P	F	E	P
crabgrass	FG	E	GE	PF	FG	P	P	P	GE	E	P	P	P	P
crotalaria, showy	G	P	P	P	P	GE	---	---	P	G	E	E	G	---
croton, tropic	G	P	P	P	P	G	P	P	P	GE	GE	G	GE	P
crowfootgrass	G	E	FG	P	FG	P	P	P	G	E	P	P	P	P
dayflower, Benghal	PF	G	P	G	---	---	---	---	P	F	F	P	P	P
eclipta	G	P	P	---	---	G	GE	---	P	G	G	GE	G	---
goosegrass	P	E	G	P	FG	P	P	P	G	E	P	P	P	P
jimsonweed	G	P	P	FG	E	E	G	P	P	E	E	E	E	G
johnsongrass, seedling	G	F	GE	GE	FG	P	P	P	GE	E	P	P	P	P
johnsongrass, rhizome	F	P	FG	G	P	P	P	P	G	E	P	P	P	P
lambsquarters, common	E	FG	P	P	G	PF	G	P	P	E	G	G	E	F
morningglory, annual	E	P	P	G	FG	GE	FG	P	P	FG	G	GE	E	G
nutsedge, purple	P	P	P	G	FG	P	P	P	P	G	P	P	P	P
nutsedge, yellow	P	F	P	FG	FG	F	P	P	P	FG	F	P	P	P
panicum, fall	G	FG	GE	F	FG	P	P	P	E	E	P	F	P	P
panicum, Texas	G	FG	GE	PF	---	P	P	P	GE	E	P	P	P	P
pigweed spp.	FG	G	P	GE	P	GE	FG	G	P	E	GE	G	E	F
ALS-resistant	FG	G	P	P	P	GE	FG	P	P	E	GE	G	E	F
glyphosate-resistant	FG	G	P	GE	P	GE	FG	G	P	P	GE	G	E	F
poinsettia, wild	GE	G	P	PF	---	G	FG	G	P	GE	G	GE	E	P
purslane, common	G	G	P	---	---	---	---	---	P	G	G	E	---	G
pusley, Florida	P	F	P	P	---	GE	G	G	P	FG	E	E	P	P
redweed (chocolateweed)	G	P	P	F	---	---	G	---	P	G	GE	---	E	P
ragweed, common	E	P	P	P	F	GE	G	F	P	GE	GE	E	E	F
sandbur, field	G	G	G	---	---	P	P	P	G	E	P	P	P	P
senna, coffee	GE	P	P	F	F	FG	GE	G	P	GE	G	E	E	F
sesbania, hemp	GE	P	P	P	---	E	P	P	P	PF	E	E	E	P
sicklepod	G	P	P	P	P	P	P	FG	P	E	P	P	E	F
sida, prickly	G	P	P	PF	G	P	P	PF	P	G	G	P	E	P
signalgrass, broadleaf	G	P	GE	G	FG	P	P	P	GE	E	P	P	P	P
smartweed, Pennsylvania	GE	P	P	F	---	G	G	F	P	G	GE	G	E	P
spurge	G	---	P	G	---	G	---	---	P	G	G	G	E	F
starbur, bristly	GE	F	P	PF	---	---	G	---	P	GE	FG	P	E	PF
velvetleaf	E	P	P	PF	E	P	E	P	P	GE	FG	PF	E	P
vol. corn	F	P	E	G	P	F	G	P	GE	E	F	F	P	P
RR hybrids	F	P	E	G	P	F	G	P	GE	P	F	F	P	P
RR/LL hybrids	P	P	E	G	P	F	G	P	GE	P	F	F	P	P

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

[2]Use only on glufosinate-tolerant (Liberty-Link [LL]) soybean varieties.

[3]For control of listed weeds, these herbicides must be applied prior to weed emergence or tank mixed with a foliar active herbicide.

[4]Use only on glyphosate-tolerant (Roundup Ready [RR], Roundup Ready 2) soybean varieties.

[5]Use only on Roundup Ready 2 Xtend soybean varieties.

Postemergence Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC/1.9EW (*carfentrazone*)	0.5-1.5 fl oz	0.008-0.023 lb	14	3 days	12 hours

Comments: Apply AIM to soybean from V3 up to the V10 stage. Do not apply AIM from emergence through V2 growth stage. Coverage is essential for optimum performance on weeds. Controls velvetleaf, annual morningglory, and *ALS- and glyphosate-resistant Palmer amaranth (up to 4" tall)*. Coverage is essential for optimum activity. May cause temporary burn, speckling, or necrosis of the soybean leaves. Add 1 qt of NIS per 100 gallons of spray solution. May be tank mixed with GLYPHOSATE for broader spectrum control in Roundup Ready (RR) soybean only. Do not use with diphenylether herbicides (examples include ULTRA BLAZER, REFLEX, COBRA). Do not apply more than 1.5 fl oz/A of AIM per season. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**

Anthem 2.15EC (*pyroxasulfone* + *fluthiacet-methyl*)	4.0-9.0 fl oz	0.082-0.163 lb + 0.003-0.006 lb	15 + 14	7 days	12 hours

Comments: Apply ANTHEM from planting through the third trifoliate stage (V3). Under high moisture conditions the crop may experience some temporary crop response. The crop will rapidly outgrow these effects and develop normally with no reduction in yield. On coarse textured soils (with less than 3% organic matter), do not apply more than 6.8 oz/A of ANTHEM per cropping season. On other soil types, do not apply more than 11.4 oz/A of ANTHEM per cropping season. For enhance control of larger weeds, ANTHEM may be tank mixed with CADET, MARVEL, or other appropriate postemergence soybean herbicides.

Assure II 0.88E (*quizalofop*)	5-12 fl oz	0.034-0.069 lb	1	80 days	12 hours

Comments: Apply 7-8 oz/A overtop to control annual grasses up to 6" tall. Apply 5 oz/A to control volunteer RR-corn in RR-soybean. For control of rhizome johnsongrass, apply 5 oz of Assure II when johnsongrass is 10-24" tall and then retreat with 5 oz when regrowth reaches 6-10" tall. For bermudagrass control, apply 10-12 oz/A at 3" tall (up to 6" runners). Add COC at 1 gal/100 gallons or 1 qt/100 gallons of spray mixture. Do not exceed 18 oz/A in a growing season. Do not apply ASSURE II after pod set. **Rainfast interval = 1 hour.**

Basagran 4S (*bentazon*)	1.5-2.0 pt	0.75-1.0 lb	6	12 days	48 hours

Comments: Soybean is tolerant of BASAGRAN at all growth stages. Controls cocklebur, bristly starbur, annual morningglory, and prickly sida. At the high rate, provides temporary suppression of yellow nutsedge (regrowth is likely). May cause slight leaf burn or speckling. Treat when broadleaf weeds are small and actively growing (less than 4" tall). Adjust rate according to weed size as noted on label. Add COC at 1-2 pt/A or UAN (28-32%) at 4-8 pt/A or AMS at 2.5 lb/A. Do not apply more than 4 pt/A of BASAGRAN per season. **Rainfast interval = 4 hours.**

Cadet 0.91EC (*fluthiacet-methyl*)	0.4-0.6 fl oz	0.003-0.004 lb	14	60 days	12 hours

Comments: Apply CADET after the 1st trifoliate through full flowering growth stage. Controls *glyphosate- and ALS-resistant Palmer amaranth (less than 2 inches tall)*, annual morningglory, sicklepod. Apply in a minimum of 15 gallons per acre spray volume. Do not apply more than 1.25 fl oz/A per cropping season. Do not apply through the air. Do not let CADET sit in the sprayer or shuttle tanks overnight. Do not apply to weeds that are under drought stress. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Classic 25DF (*chlorimuron*)	0.5-0.75 oz	0.008-0.012 lb	2	60 days	12 hours

Comments: Apply CLASSIC after 1st trifoliate has fully expanded up to 60 days before crop maturity. Controls sicklepod, bristly starbur, and annual morningglory. CLASSIC is weak on Palmer amaranth. Include NIS at 1 qt/100 gallons or COC at 1 gal/100 gallons spray solution. May be tank mixed with glyphosate for broader spectrum control in RR-soybean (use the lower CLASSIC rate at 0.25-0.33 oz/A). Do not tank mix CLASSIC with organophosate insecticide or do not apply CLASSIC within 14 days before or after an application of organophosate insecticide as severe crop injury may occur. Do not tank mix CLASSIC with PYTHON as severe crop injury may occur. **Rainfast interval = 1 hour.**

Cobra 2EC (*lactofen*)	12.5 oz	0.2 lb	14	45 days	12 hours

Comments: Apply COBRA to soybeans anytime, but before R6 (full seed set). Controls *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)*, annual morningglory, Florida pusley, and bristly starbur. May cause temporary leaf burn, bronzing, or speckling. Add 1-2 pt COC per 100 gallons of spray solution plus 2-4 lb/A of AMS. Do not exceed 25 oz/A of COBRA per season. Do not apply COBRA when weeds or the crop is under stress conditions or do not favor active weed growth. **Rainfast interval = 2 hours.**

Dual Magnum 7.62EC (*s-metolachlor*)	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours

Comments: Apply DUAL MAGNUM from emergence up through the 3rd trifoliate growth stage. Will not control emerged weeds. Provides residual control of small seeded annual grasses and broadleaves. Consult label for tank mix partners. **Rainfast interval = Not applicable**

ET 0.208EC (*pyraflufen ethyl*)	0.5-0.75 fl oz	0.0008-0.0012 lb	14	70 days	12 hours

Comments: Apply ET from crop emergence up to the V6 growth stage in a minimum of 5 gal per acre by air or 10 gal per acre by ground. Controls *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)* and annual morningglory. Do not apply more than 1.0 fl oz/A per application. Do not make more than 2 applications of ET per cropping cycle. Some transient speckling may occur on the leaves of the crop; this effect is temporary and will not occur on new growth. **Rainfast interval = 1 hour.**

FirstRate 84WDG (*chloransulam-methyl*)	0.3 oz	0.016 lb	2	65 days	12 hours

Comments: FIRSTRATE may be applied after emergence up to the 50% flowering stage. Application prior to full emergence of the first soybean trifoliate leaf may cause temporary yellowing or chlorosis. Add 1-2 pt NIS plus 2.5 gal UAN or COC at 1.2 gal or MSO at 1.2 plus 2.5 gal UAN per 100 gallon of spray solution. Controls bristly starbur, annual morningglory, common ragweed, and sicklepod. Weak on Palmer amaranth. For best results, spray annual morningglory before runners emerge. Applications made to sicklepod beyond the 1-leaf stage will result in reduced control. A second 0.3 oz/A FIRSTRATE application may be necessary 7-10 days afterward to control sicklepod. FIRSTRATE may be tank mixed with ASSURE II, BASAGRAN, CLASSIC, COBRA, GLYPHOSATE, FLEXSTAR, FUSION, HARMONY GT, PHOENIX, POAST PLUS, PURSUIT, RAPTOR, REFLEX, RELIANCE, RESOURCE, SELECT, SYNCHRONY STS, or ULTRA BLAZER. **Rainfast interval = 2 hours.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Flexstar 1.88SC (*fomesafen* + adjuvants)	1.0-1.5 pt	0.24-0.35 lb	14	45 days	24 hours
Reflex 2EC (*fomesafen*)	1.0-1.5 pt	0.25-0.38			

Comments: Controls annual broadleaf weeds such as cocklebur, *ALS- and glyphosate-resistant Palmer amaranth*, and annual morningglory. Add NIS at 1-2 qt or COC at 0.5-1.0 gallons per 100 gallons of spray solution. Do not apply after soybeans begin blooming. Do not exceed 1.5 pt per acre per season. Avoid applying FLEXSTAR or REFLEX to weeds that are under stress from moisture, temperature, or chemical injury as reduce weed control and/or increased crop response may occur. **Rainfast interval = 1 hour.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Flexstar GT 3.29SL	3.0-4.5 pt			45 days	24 hours
(*fomesafen* + *glyphosate*)		0.25-0.37 lb + 0.99-1.5 lb ae	14 + 9		
Flexstar GT 3.5 2.82SL	3.5-5.3 pt				

Comments: USE ONLY ON SOYBEAN VARIETIES DESIGNATED AS ROUNDUP READY! Controls annual broadleaf weeds such as cocklebur, *ALS- and glyphosate-resistant Palmer amaranth (less than 3 inches tall)*, and annual morningglory. Add AMS at 8.5 lb per 100 gal of spray solution. Do not exceed 4.5 pt/A (FLEXSTAR GT) or 5.3 pt/A (FLEXSTAR GT 3.5) per season. Avoid applying FLEXSTAR GT to weeds that are under stress from moisture, temperature, or chemical injury as reduce weed control and/or increased crop response may occur. **Rainfast interval = 1 hour.**

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Fusilade DX 2EC (*fluazifop-p-butyl*)	8-12 fl oz	0.125-0.188 lb	1	60 days	12 hours

Comments: Controls annual and perennial grasses before they exceed 6-8" tall. For rhizome johnsongrass control, apply 12 fl oz/A when it is 8-18" tall. Make a second application (8 fl oz/A) when regrowth is 6-12" tall. For bermudagrass, apply 12 fl oz/A when runners are 4-8" long, and repeat 8 fl oz/A when re-growth reaches 4-8". Add COC at 1 gal/100 gallon or NIS 2 pt/100 gallon of spray solution. Controls volunteer corn in all types of soybean varieties. Do not apply more than 30 fl oz/A of FUSILADE per growing season. Do not apply more than 24 fl oz/A from emergence to V5 growth stage. Do not apply more than 6 fl oz/A from bloom to R1 growth stage. **Rainfast interval = 1 hour.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Fusion 2.56EC	8-12 fl oz			90 days	24 hours
(*fluazifop-p-butyl*		0.125-0.189 lb	1		
+		+			
fenoxaprop-p-ethyl)		0.035-0.053 lb	1		

Comments: Apply 8 fl oz/A for control of most annual grasses before they exceed 6-8" tall. For rhizome johnsongrass, apply 10-12 fl oz/A for control of johnsongrass 8-18" tall. A second 8 fl oz/A treatment may be applied to control regrowth 6-12" tall. For bermudagrass, treat 4-8" runners with 12 fl oz/A, and then apply a second application of 8 fl oz/A to 4-8" re-growth. Add COC at 1 gal/100 or NIS at 2 pt/100 gallon of spray solution. Controls volunteer corn in all types of soybean varieties. **Rainfast interval = 1 hour.**

Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal.	22-44 fl oz	0.75-1.5 lb ae			

Comments: USE ONLY ON SOYBEAN VARIETIES DESIGNATED AS ROUNDUP READY! Apply from emergence through flowering growth stage (R2 growth stage). Controls annual grasses and broadleaf weeds*. Will not control glyphosate-resistant Palmer amaranth*. Single or sequential applications may be made. Do not exceed 5.96 lb ae/A (5.3 qt/A) for all combined application types over the entire year. Do not exceed 2.25 lb ae/A (64 fl oz/A) for all combined applications from emergence through R2 growth stage. Do not apply GLYPHOSATE to weeds that are drought stressed; apply only to actively growing weeds. Tank mix partners include BASAGRAN, ULTRA BLAZER, COBRA, FIRSTRATE, FLEXSTAR, HARMONY GT XP, PURSUIT, RAPTOR, or REFLEX. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Resistance Management: *Glyphosate-resistant Palmer amaranth is spreading rapidly throughout South Carolina. Continued reliance on glyphosate-only programs will enhance selection and spread of resistant biotypes. Tank mixing glyphosate with other chemistries must be utilized. Biotypes of Palmer amaranth resistant to both ALS- and glyphosate chemistries have been recently confirmed in South Carolina.*

Harmony GT XP 75DF (*thifensulfuron-methyl*)	0.083 oz	0.004 lb	2	45 days	12 hours
Harmony SG 50DF	0.125 oz				

Comments: Apply to soybeans any time after the first trifoliate has fully expanded. Controls *glyphosate-resistant Palmer amaranth* up to 4" tall (*will not control ALS-resistant Palmer amaranth*). Add NIS at 1-2 pt /100 gallons or COC at 4 pt/100 gallons of spray solution plus a nitrogen fertilizer solution (UAN, 28%) at 2-4 qt/A or AMS at 2-4 lb/A. Do not tank mix HARMONY GT XP with organophosate insecticide or do not apply HARMONY GT XP within 14 days of an application of organophosate insecticide as severe crop injury may occur. *HARMONY GT XP rate can be increased up to 0.33 oz/A IF applying OVER-THE-TOP a STS or STS/RR SOYBEAN VARIETY. HARMONY SG rate can be increased up to 0.5 oz/A IF applying OVER-THE-TOP a STS or STS/RR SOYBEAN VARIETY.* **Rainfast interval = 3 hours.**

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season*

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Liberty 280SL 2.34S (*glufosinate)*	29-36 fl oz	0.53-0.66 lb	10	70 days	12 hours
Interline 2.34SL					

Comments: USE ONLY ON SOYBEAN VARIETIES DESIGNATED AS LIBERTY-LINK! Spray coverage, warm temperatures, high humidity and bright sunlight are essential for maximum LIBERTY performance. Controls annual grasses, broadleaf weeds, and *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)*. If environmental conditions prevent timely herbicide application, a single application up to 36 fl oz/A from emergence up to but not including bloom growth stage may be made followed by one additional application at a maximum of 29 fl oz/A with a season maximum of 65 fl oz. Consult label regarding tank mix partners. Add AMS at 3 lb/A to the spray solution if weeds are under stress. **Rainfast interval = 4 hours.**

Resistance Management: *Do not rely solely on LIBERTY for complete weed control in soybeans. The addition of residual herbicide(s) at burndown, planting, or tank-mixed with LIBERTY will help ensure optimum weed management particularly if environmental conditions delay timely POST applications. Residual herbicides at planting reduce early season weed competition and are a key component of good weed resistance strategies*.

Outlook 6EC (*dimethenamid-p*)	12-18 oz	0.56-0.84 lb	15	---	12 hours

Comments: Apply OUTLOOK from the first trifoliate leaf stage to the fifth-trifoliate leaf stage. Will not control emerged weeds. Provides residual control of small seeded annual grasses and broadleaves. Consult label for tank mix partners. **Rainfast interval = Not applicable**

Poast 1.5E (*sethoxydim*)	1.0-1.5 pt	0.19-0.28 lb	1	75 days	12 hours
Poast Plus 1E	1.5-2.25 pt				

Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A (2.25 pt/A POAST PLUS) up to 25" tall. A second 1.0 pt/A (1.5 pt/A POAST PLUS) treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A (2.25 pt/A POAST PLUS), and then apply a second application of 1.0 pt/A (1.5 pt/A POAST PLUS) to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or COC 2 pt/A. Include UAN at 4-8 pt/A or AMS at 2.5 lb/A for enhanced crabgrass activity. Do not apply more than 2.5 pt/A of POAST per application. Do not apply more than 5.0 pt/A of POAST per season. Do not apply more than 3.75 pt/A of POAST PLUS per application. Do not apply more than 7.5 pt/A of POAST PLUS per season. Consult label for tank mix partners. Controls volunteer corn in all types of soybean varieties. **Rainfast interval = 1 hour.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Prefix 5.29EC (*s-metolachlor* + *fomesafen*)	2.0-2.33 pt	1.09-1.24 lb + 0.24-0.28 lb	15 + 14	90 days	

Comments: Apply PREFIX to soybean from cracking through the third foliate growth stage. Necrotic spotting, bronzing, leaf crinkling or curling of soybean leaves may occur following postemergence applications, but soybeans soon outgrow these effects and develop normally. For enhanced control of emergence weeds in glyphosate-tolerant soybeans, tank mix PREFIX with glyphosate. Tank mix a NIS if PREFIX is applied alone or if GLYPHOSATE product does not contain a built-in adjuvant. Do not use a COC when applying PREFIX as these spray adjuvants may increase soybean injury. PREFIX may be tank mixed with KARATE or ENDIGO ZC insecticides. Do not exceed 2.33 pt/A in a singlye postemergence application. Do not exceed 3.0 pt/A of PREFIX per season. Do use PREFIX postemergence if applied preplant, preplant incorporated, or preemergence previously.

Resistance Management: *Make only **one** application of a group 14 containing herbicide per growing season.*

Pursuit 70DF (*imazethapyr*)	1.44 oz	0.063 lb	2	85 days	4 hours
Pursuit 2AS	4.0 oz				

Comments: Apply anytime after soybean emergence but before weeds exceed 3 inches. Controls bristly starbur, crabgrass, annual morningglory, and *glyphosate-resistant Palmer amaranth (less than 3" tall; will not control ALS-resistant Palmer amaranth)*. Provides some suppression of yellow and purple nutsedge. Early application is essential for optimum weed control. Add NIS at 1.0 qt or COC at 1 gal plus UAN at 1.25-2.5 gal per 100 gal spray solution. Only one application of PURSUIT may be made during the growing season (Preplant, Preplant Incorporated, Preemergence, or Postemergence). **Rainfast interval = 1 hour.**

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Raptor 1AS (*imazamox*)	4.0-5.0 fl oz	0.03-0.04 lb	2	None	4 hours

Comments: Apply anytime after soybean emergence up to bloom (but before weeds exceed 3 inches). Controls bristly starbur, crabgrass, Texas Panicum, annual morningglory, and *glyphosate-resistant Palmer amaranth (less than 4" tall; will not control ALS-resistant Palmer amaranth)*. Apply the 4 fl oz/A rate when following a soil-applied grass herbicide (i.e., PROWL). The 5 oz/A rate should be used if no preemegence herbicide was applied. Add COC at 1 to 2 gallons/100 gallons of spray solution or a non-ionic surfactant at 1 qt/100 gallons of spray solution is required. Only one application of RAPTOR is permitted during the growing season. Do not apply more than 5 fl oz/A of RAPTOR per growing season. May tank mix with GLYPHOSATE (RR-soybean only), FIRSTRATE, or ULTRA BLAZER. **Rainfast interval = 1 hour.**

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Resource 0.86EC (*fumiclorac*)	4.0-12.0 oz	0.027-0.081 lb	14	60 days	12 hours

Comments: Apply anytime after soybean emergence until 60 days before harvest. Controls annual morningglory, prickly sida, and *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)*. For enhanced control of annual morningglory in RR-soybeans only, add 2-4 oz/A of RESOURCE to the GLYPHOSATE tank (up to 6" vine). Apply 6-8 oz/A to control volunteer cotton in RR-soybeans, Liberty-Link-soybeans, and conventional soybeans. Add COC at 1 qt/A to the final spray solution. Do not apply more than 12 oz/A in a single application or more than 16 oz/A during a single growing season. **Rainfast interval = 1 hour.**

Scepter 70DG (*imazaquin*)	1.4-2.8 oz	0.063-0.125 lb	2	90 days	12 hours

Comments: Apply anytime after soybean emergence (better results with small soybeans). Controls *glyphosate-resistant Palmer amaranth (use higher rate; will not control ALS-resistant biotypes)*, common cocklebur, and wild poinsettia. A soil active grass herbicide (PROWL, DUAL MAGNUM, or INTRRO) should follow in a separate application for grass control. Tank mix with GLYPHOSATE (RR-soybeans only) to enhance control of sicklepod and annual grass weeds. Add NIS at 1 qt per 100-gallon spray solution. Do not apply to when weeds and soybeans are under stress. Do not apply more than once per year. **Rainfast interval = None.**

Resistance Management: *Make only **one** application of a group 2 containing herbicide per growing season.*

Select 2EC (*clethodim*)	6.0-16.0 oz	0.091-0.25 lb	1	70 days	12 hours
Select MAX 0.97EC	12.0-32.0 oz				

Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 8 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. A second 6 oz/A (6-18 oz/A SELECT MAX) treatment may be applied to control regrowth. For bermudagrass, treat 6" runners with 8 oz/A (16 oz/A SELECT MAX), and then apply a second application of 8 oz/A (16 oz/A SELECT MAX) to 6" re-growth. Add COC at 1 qt/A plus AMS at 2.5 lb/A for enhanced johnsongrass and volunteer corn activity. Consult label for tank mix partners. Controls volunteer corn in all types of soybean varieties**. Rainfast interval = 1 hour.**

Sequence 5.25L (*glyphosate* + *s-metolachlor*)	2.5 pt	0.75 lb ae + 0.94 lb	9 + 15	50 days	24 hours

Comments: USE ONLY ON SOYBEAN VARIETIES DESIGNATED AS ROUNDUP READY! Apply from cracking up through the 3rd trifoliate. Controls annual grasses and broadleaf weeds. *s*-metolachlor component provides residual grass and small seeded broadleaf weed control. Do not apply if DUAL MAGNUM or other s-metolachlor containing herbicide was applied before the SEQUENCE application. Do not exceed 3.5 pt/A in a single application or 3.5 pt/A in a single season. **Rainfast interval = suggest 2 hours minimum.**

Storm 4EC (*bentazon* + *aciflourfen*)	1.5 pt	0.5 lb + 0.25 lb	6 + 14	75 days	48 hours

Comments: Apply to soybeans after the 2nd fully expanded trifoliate, but before weeds exceed the 4-leaf stage (small, actively growing weeds are the key to success). Controls common cocklebur, bristly starbur, annual morningglory, tropic croton, and spurred anoda. Weak on Palmer amaranth. Add COC at 1.0 qt/A or NIS at 1.0-2.0 pt/100 gal of spray solution. Causes temporary foliar burn on soybean. Equivalent to 1 pt/A of BASAGRAN and 1 pt/A of ULTRA BLAZER. Do not apply more than 1.5 pt/A per application or 3.0 pt/A of STORM per season. Do not apply to weeds and crop that are under stress. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Ultra Blazer 2L (*aciflourfen*)	0.5-1.5 pt	0.125-0.375 lb	14	75 days	48 hours

Comments: Apply to soybeans after the 2nd fully expanded trifoliate but before weeds exceed 4" tall (small, actively growing weeds are the key to success). Controls *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall at the 1.5 pt/A rate)*, bristly starbur, annual morningglory, tropic croton, and spurred anoda. For control of annual morningglories, use a sequential application of ULTRA BLAZER of 1 pt/A. Add NIS at 1.0-2.0 pt/100 gal spray solution. Tank mix with GLYPHOSATE for enhanced morningglory and *ALS- and glyphosate-resistant Palmer amaranth* control in RR-soybean. Do not apply to weeds and crop that are under stress. **Rainfast interval = 4 hours.**

Warrant 3.0ME (*acetochlor*)	3 pt	1.125 lb	15	---	12 hours

Comments: Apply WARRANT over-the-top from emergence until R2 growth stage. Provides residual control of small seeded broadleaves and grasses. Optimum application timing for first broadcast application is V2-V3 leaf stage followed by a second directed application after V5 leaf stage. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE (use only on ROUNDUP READY varieties) or LIBERTY (use only on LIBERTY LINK varieties) for control of existing weeds. Do not apply WARRANT using a sprayable fluid fertilizer as the carrier because of severe crop injury may occur. Do not apply WARRANT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Warrant Ultra 3.45ME (*acetochlor* + *fomesafen*)	48 fl oz	1.07 lb + 0.24 lb	15 + 14	45 days	12 hours

Comments: Apply WARRANT ULTRA after planting soybeans but before soybeans rech the R2 growth stage. Environmental conditions that follow application of WARRANT ULTRA including cold, wet soils or water logged conditions from excessive rain may result in crop injury. Do not apply *acetochlor* within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well. Do not graze treated area or feed treated forage to livestock following application of WARRANT ULTRA.

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Xtendimax 2.9SL (*dicamba*)	22 fl oz.	0.5 lb ae	4	7 days	24 hours

Comments: USE ONLY ON SOYBEAN VARIETIES DESIGNATED AS ROUNDUP READY 2 XTEND! Apply XTENDIMAX over-the-top to from emergence (cracking) up to and including the beginning bloom stage (R1). Do not make XTENDIMAX applications after R1 growth stage. *XTENDIMAX with VAPORGRIP technology may only be tank mixed with products (i.e., other pesticides, adjuvants, and drift control agents) that have been tested and found not to adversely affect XTENDIMAX with VAPORGRIP technology offsite movement potential. A list of these approved tank mix partners can be found at www.xtendimaxapplicationrequirements.com. Use only the TeeJet TTI11004 nozzles with a maximum operating pressure of 63 psi when applying XTENDIMAX*. Select a ground speed that will deliver the desired spray volume while maintaining the correct spray pressure, but do not exceed a ground speed of 15 miles per hour (slower speeds typically result in better coverage and deposition in the target area). Do not apply XTENDIMAX during a temperature inversion (increased potential for drift). Do not tank mix adjuvant products containing ammonium salts, such as ammonium sulfate and urea ammonium nitrate with XTENDIMAX. Apply XTENDIMAX in a minimum of 10 gal of water per acre. Provides control of small broadleaf weeds (less than 4 inches) including glyphosate-resistant Palmer amaranth. Sequential applications may be required to control subsequent new flushes of broadleaf weeds. Allow at least 7 days between applications. For resistance management, avoid making more than 2 single applications of a group 4 herbicide unless mixed with another mechanism of action. *Do not apply XTENDIMAX to soybean with ROUNDUP READY 2 XTEND technology using aerial spray equipment.* Do not make application of XTENDIMAX if rain is expected in next 24 hours. Clean spray equipment immediately after applying XTENDIMAX using a triple rinse procedure as described in the label.

Maximum XTENDIMAX application rates:

Combined total per year for all applications	88 fl oz. per acre (2.0 lb ae dicamba per acre)
Total of preplant, at-planting, and preemergence applications	44 fl oz. per acre (1.0 lb ae dicamba per acre)
Total in-crop applications from emergence up to 7-days before harvest (pre-harvest).	88 fl oz. per acre (2.0 lb ae dicamba per acre)
Maximum in-crop single application	22 fl oz. per acre (0.5 lb ae dicamba per acre)

Wind Speed Requirements when applying XTENDIMAX:

Wind Speed	Application conditions and restrictions
<3 mph	DO NOT APPLY XTENDIMAX with VAPORGRIP technology
3 to 10 mph	Optimum application conditions for XTENDIMAX with VAPORGRIP technology provided all other application requirements in this label are met.
10 to 15 mph	Do not apply this product when wind is blowing toward non-target sensitive areas.
>15 mph	DO NOT APPLY XTENDIMAX with VAPORGRIP technology.

Buffer requirements for sensitive areas when applying XTENDIMAX: Maintain a 110-foot downwind buffer (22 fl oz of XTENDIMAX per acre) or a 220-foot downwind buffer (44 fl oz of XTENDIMAX per acre) between the last treated row and closest downwind edge (in the direction in which the wind is blowing). No application swath can be inititated in, or into an area that is within the applicable buffer distance. The following areas may be included in the buffer distance when adjacent to field edges: roads, paved or gravel surfaces; planted agricultural fields containing corn, dicamba tolerant cotton, dicamba tolerant soybean, sorghum, proso millet, small grains, and sugarcane; agricultural field that have been prepared for planting; and areas covered by the footprint of a building, silo, or other man made structure with walls and/or roof.

Non-target susceptible commercially grown broadleaf crops and trees precautions: Failure to follow application requirements in the XTENDIMAX label could result in severe injury or destruction to desirable sensitive broadleaf crops and trees when contacting the roots, stems, or foliage. Do not apply XTENDIMAX when wind is blowing toward adjacent commercially grown dicamba sensitive broadleaf crops including, but not limited to, commercially grown tomatoes and other fruiting vegetables (EPA crop group 8), cucurbits (EPA crop group 9), tobacco, and grapes.

AVOIDING SPRAY DRIFT AT THE APPLICATION SITE IS THE RESPONSIBILITY OF THE APPLICATOR!

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Zidua 0.85WG (*pyroxasulfone*)	1.0-2.1 oz	0.053-0.112 lb	15	None	12 hours

Comments: Apply ZIDUA to soybeans from emergence to the third-foliate leaf stage. For additional residual and/or activity on emerged weeds EXTREME (Roundup Ready varieties only!), OUTLOOK, PROWL H2O, PURSUIT, RAPTOR, and GLYPHOSATE (Roundup Ready varieties only!). Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils.

2,4-DB 2S	0.7-0.9 pt	0.18-0.23 lb	4	60 days	48 hours
2,4-DB 1.75S	0.8-1.0 pt				

Comments: Apply 2,4-DB to soybeans approximately 7-10 days before bloom up to mid-bloom (soybeans are about knee high and actively growing). Broadcast applications outside of this time period could result in yield reduction. Controls common cocklebur, annual morningglory, and pigweed (less than 3"). Several tank mix partner options are available, consult label. Do treat soybeans with tank mixes of 2,4-DB and carbaryl (SEVIN) insecticides as severe crop injury may occur. **Rainfast interval = None.**

Postemergence Directed Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC/1.9 EW (*carfentrazone*)	0.5-1.5 fl oz	0.008-0.023 lb	14	---	12 hours

Comments: Apply AIM as a directed spray toward the base of the plant to avoid contact with the soybean foliage. The use of spray shields will further protect the crop plant from injury. Controls velvetleaf, annual morningglory, and *ALS- and glyphosate-resistant Palmer amaranth (up to 4" tall)*. Add 1 qt of NIS per 100 gallons of spray solution. Do not feed treated soybean forage or hay to livestock. Do not tank mix and apply AIM herbicide with other diphenylether herbicides (examples include ULTRA BLAZER, REFLEX, COBRA). Do not apply more than 1.5 fl oz/A of AIM per season. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**

Gramoxone SL 2E (*paraquat*)	1.0-2.0 pt	0.25-0.50 lb	22	15 days	24 hours
paraquat 3S	0.75-1.5 pt				

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Apply GRAMOXONE as a directed spray using a hooded or shielded sprayer to avoid contact with soybean foliage when weeds are small and actively growing. Allow 14 days between applications. For control of 2-3 inch sicklepod or pigweed, use the 8 fl oz/A rate. Tank mix 2,4-DB (0.2 lb ai/A) for enhanced control of annual morningglory. Use the higher rate on weeds larger than 6 inches or taller, but they may not be controlled. Do not exceed 11.6 pt/A per season for all uses. **Rainfast interval = 30 minutes.**

2,4-DB 2S	0.7-1.6 pt	0.18-0.40 lb	4	60 days	48 hours
2,4-DB 1.75S	0.8-1.8 pt				

Comments: Apply 2,4-DB as a directed spray using drop nozzles where contact only occurs on the bottom third of the soybean plant. Do not allow spray to contact growing terminals of the plant. Do not apply more than 2 applications of 2,4-DB in a growing season. To control annual morningglory up to 3 inches in length, use the 0.7-0.9 pt/A rate of 2,4-DB. For all other broadleaf weeds, apply 2,4-DB at the 1.4-1.6 pt/A rate. Do treat soybeans with tank mixes of 2,4-DB and carbaryl (SEVIN) insecticides as severe crop injury may occur. **Rainfast interval = None.**

Harvest Aids for Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (*carfentrazone*)	1.0-2.0 fl oz	0.016-0.032 lb	14	3 days	12 hours
Aim 1.9EW					

Comments: Apply to soybeans after maturity and grain has begun to dry down. Use a minimum of 10 GPA of final spray volume (5 GPA for aerial applications). Desiccates annual morningglory and other harvest impediments. If AIM was applied previously in crop, then it must be counted in the seasonal maximum use rate. Coverage is essential for maximum performance. Add a COC (1-2 gal/100 gals), NIS (1 qt/100 gals), or MSO (1-2 gal/100 gals) to the spray solution. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**

Glyphosate acid equivalent (ae) 4.5 lb ae/gal	**	**	9	**	12 hours

Comments: Apply to soybeans after pods have set and have lost all green color. Preharvest applications of GLYPHOSATE are not recommended for soybeans grown for seed as a reduction in vigor or germination may occur. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

****Roundup Ready-soybeans:** maximum use rate by ground or air for a preharvest application is 22 fl oz/A (0.75 lb ae/A); preharvest interval is 14 days.
****Conventional-soybeans:** maximum use rate by ground for preharvest application is 3.3 qt/A (4.8 lb ae/A); applications by air are limited to 44 fl oz/A (1.5 lb ae/A); preharvest interval is 7 days.

Gramoxone SL 2E (*paraquat*)	8.0-16.0 fl oz	0.125-0.25 lb	22	15 days	12 hours
paraquat 3S	5.4-10.7 fl oz				

Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. For indeterminate varieties, apply GRAMOXONE when at least 65% of the soybean pods have reached mature brown color or when seed moisture is 30% or less. For determinate soybean varieties, apply GRAMOXONE when plants are mature with fully developed pods, ½ of the leaves have dropped, and the remaining leaves are yellowing. Do not apply within 15 days of harvest. For better desiccation of larger weeds, use the higher rate. Add NIS at 1 qt per 100 gal of spray solution. **Rainfast interval = 30 minutes.**

Defol 7.5S (*sodium chlorate*)	3.2 qt	6.0 lb	NC	7 to 10 days	12 hours

Comments: Apply DEFOL 7-10 days before anticipated harvest when soybeans are mature and ready for harvest to desiccate weeds. Apply in a minimum of 20 GPA for ground (5 GPA for air) applications. Weather conditions that favor defoliation include high temperatures, high humidity, low wind velocity, and adequate soil moisture. If rain is anticipated within 24 hours, delay application whenever possible. Defoliation may be slowed by daytime temperatures below 60 F. Apply DEFOL with a NIS at 2-4 pt per 100 gal of spray solution. Do not graze treated fields or feed treated foliage. **Rainfast interval = 24 hours.**

Sharpen 2.85SC (*saflufenacil*)	1.0-2.0 fl oz	0.022-0.044 lb	14	3 days	12 hours

Comments: Apply SHARPEN after soybeans have reached physiological maturity (all pods and seed have no more green color). For indeterminate varieties apply (greater than 65% brown pods and greater than 70% leaf drop) or when seed moisture is 30% or less, and for determinate varieties, apply when beans are fully developed with more that 50% leaf drop, and remaining leaves are yellowing. Apply in a minimum of 10 GPA for ground (5 GPA for aerial) applications. Apply SHARPEN with MSO and ammonium-based adjuvant system. Do not apply to soybean grown for seed production. Do not graze treated fields or feed treated foliage. **Rainfast interval = 1 hour.**

SOYBEAN INSECT CONTROL

Jeremy K. Greene, Research/Extension Entomologist

The keys to managing insect pests in soybean are to:

1. Scout fields during high-risk periods for your area.
2. Correctly identify insect pests.
3. Use treatment thresholds to make spray decisions.
4. Use the safest, most economical and environmentally sound insecticide and rate.
5. Accurately calibrate spray equipment, and properly apply insecticides.

SCOUTING

Check soybeans regularly from early vegetative stages to beginning maturity (R7). If velvetbean caterpillars (mainly the southern Coastal Plain) or stink bugs are a problem in your area, continue scouting until leaves shed (well into R7). Place a high priority on checking fields in bloom from the last week of July through August. Corn earworm moths are attracted to blooming fields and will lay more eggs in open-canopied beans on high spots and lighter soil areas. Stink bugs can be difficult to scout for because they may not be found in all areas of a field. Stink bug damage can occur from pod set to when pods begin to yellow, but greatest injury occurs during early pod-fill. Because kudzu bugs are stem feeders, they can infest soybeans during any growth stage and should be scouted for regularly. The most important consideration for any field scouting program is to get a representative sample. If it is impossible to scout all fields, at least sample representative varieties and planting dates each week. Do not treat all fields based on what is found in one variety or maturity group.

Check in at least two different accessible areas of a field, such as opposite ends, or on a lighter and heavier soil type. In both areas move in 20 steps and take at least two samples. Take more samples if insect populations are not clearly above or below the treatment threshold level. To take each sample in conventional wide-row spacing, bend one row out of the way and place a 3 ft by 3 ft beat cloth (also called a ground or drop cloth) with dowel handles between the rows. Bend 3 feet of one row over the cloth and beat down vigorously on the soybeans at least 10 times. Move the beans back, and then count and identify insects. Divide by three to get the number of pests per row foot. Shake the cloth off thoroughly before taking another sample.

Soybeans that are drilled require insect scouting and treatment thresholds tailored for use in narrow rows. There are several sampling alternatives, but the most practical involves using a sweep net. Use a 15-inch diameter heavy-duty sweep net such that the upper edge of the net stays even with or slightly below the top of the canopy as you sweep it through the crop. Sweep forcefully with a back-and-forth motion as you walk through the field. Make one sweep with each stride. You actually make an elongated "figure 8" motion with the net; each pass covering two 38-inch rows or the equivalent width of narrow rows. Make 10 sweeps (each pass in either direction counts as a sweep); then count the number of insects in the net, being careful to sort through the leaves in the bottom of the net. Take a minimum of two 10-sweep samples in each of two different areas of the field, or more until you are confident of your estimates. Note: Sources of sweep nets are Gempler's (800-382-8473 or www.gemplers.com), Forestry Suppliers (800-647-5368 or www.forestry-suppliers.com), and SweepNets.com (408-887-7995 or www.sweepnets.com). Ask for the heavy duty 15-inch insect sweep net. Also be sure to order a replacement net.

DEFOLIATION THRESHOLDS

The general defoliation threshold for foliage-feeding pests or pest combinations is 30 percent leaf-area loss before bloom and 15 percent thereafter. There is a tendency to overestimate foliage loss, in part because insects often feed in

the upper, more visible part of the canopy. In addition, there is a tendency for the eye to focus more on damaged leaves. A technique to "calibrate" or check defoliation estimates is to remove a trifoliate leaf (three leaflets) from the top, middle, and lower part of the canopy without looking. Then take an extra leaflet from the middle canopy, for a total of ten leaflets. Look at each leaflet individually, and assign a score of 0 to 10 to each based on an estimate of the portion of leaf area that is missing. For example, a score of 1 requires that at least 10% is missing; a 3 means that 30% is eaten; a 10 indicates that all or nearly the entire leaflet is gone. Add up the score total for all ten leaflets to arrive at a defoliation estimate. Calculate several such defoliation scores and compare the average to estimates made by simply scanning the canopy.

BEAT-CLOTH THRESHOLDS

The thresholds in **Table 1 (per row ft)** and **Table 2 (per 3-ft sample)** can be used with the beat cloth method.

Table 1. Treatment thresholds **(per row ft)** for soybean insects sampled with beat cloth.

Pest	Row width (inches)				
	38	30	21	14	7
stink bug	1	0.8	0.5	0.3	0.2
corn earworm*	2	1.6	1.1	0.7	0.4
velvetbean caterpillar	4-6	4	2.7	1.8	0.9
soybean looper	6-8	5.5	3.8	2.6	1.3
*this is the pod-feeding threshold for corn earworm					

Table 2. Treatment thresholds **(per 3 row ft)** for soybean insects sampled with beat cloth.

Pest	Row width (inches)				
	38	30	21	14	7
stink bug	3	2.4	1.6	1.1	0.5
corn earworm*	6	4.7	3.3	2.2	1.1
velvetbean caterpillar	12-18	12	8.3	5.5	2.7
soybean looper	18-24	16	11.6	7.7	3.8
*this is the pod-feeding threshold for corn earworm					

SWEEP-NET THRESHOLDS

Sweep net thresholds in drilled soybeans are not as well-defined as those for beat/shake samples. The following thresholds should be considered guidelines until more research is available. Use percent defoliation estimates as an additional treatment guideline for foliage feeders. Prior to bloom, up to 30% defoliation is acceptable without economic yield loss, but once blooming begins, the guideline drops to 15% defoliation.

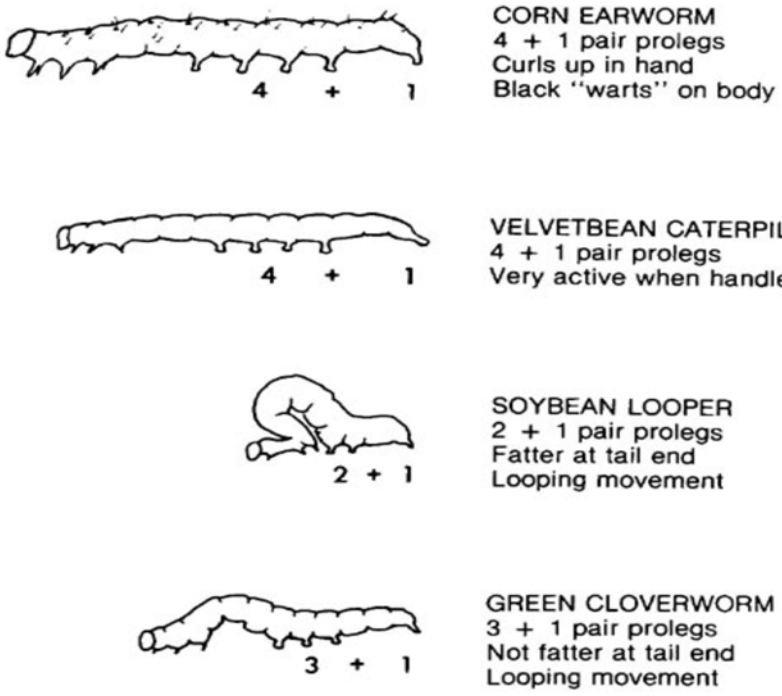
Table 3. Treatment guidelines for soybean insects sampled with a sweep net.

Pest	Number per 10 sweeps	Comments
stink bug	1-2	
corn earworm	3	or 15% foliage loss
velvetbean caterpillar	10	or 15% foliage loss
soybean looper	15	or 15% foliage loss
kudzu bug	10 (nymphs)	1 nymph per sweep
For other foliage feeders use a threshold of 30% defoliation before first bloom, 15% after first bloom.		

INSECT IDENTIFICATION

The four most common caterpillars found in soybean are the corn earworm, green cloverworm, velvetbean caterpillar, and soybean looper. Because color and size are quite variable, the field key below can be helpful in pointing out distinguishing characteristics.

FIELD KEY TO COMMON SOYBEAN CATERPILLARS



Corn Earworm. Corn earworms have many color variations, but the presence of dark “warts” and more body “hairs” helps to distinguish smaller larvae from other common soybean leps. Corn earworm also tends to curl up in a C-shape when handled. They have a 4 + 1 proleg pattern, unlike green cloverworms or loopers. The primary infestation period is from the last week of July to early September. Corn earworm, often called "podworm," is a pest throughout the state feeding on foliage, blooms, pods, and terminal stems. Corn earworms and stink bugs are the most economically important pests of soybean because they feed directly on pods.

Velvetbean Caterpillar. 4 + 1 pair prolegs (3 + 1 when small); very active when touched; light green to black; causes problems around mid-August to late October; mainly found in southern Coastal Plain, especially Beaufort, Charleston, Colleton, Hampton and Jasper counties. This late-season pest is often mistakenly called "armyworm” because it seems to appear overnight in large numbers and can rapidly strip a field. The dark color of some specimens also causes confusion. If you see large numbers of very small green worms on the shake cloth late in the season, be on the alert for

velvetbean caterpillar defoliation beginning in the top of the canopy.

Soybean Looper. 2 + 1 pair prolegs; looping movement; fatter at "tail-end" of body; usually causes problems from mid-August to mid-September, mainly in cotton production areas and southern coastal counties. The three pairs of thoracic (front) legs may be green or black. Leg color can change on the same insect as it ages and has no effect on insecticide tolerance. This pest prefers plants which are not drought-stressed. Damage usually starts in the middle of a lush canopy.

Green Cloverworm. 3 + 1 pair prolegs; looping movement; not fatter at tail-end; can be problem during July to September; seldom does significant damage by itself, statewide distribution. This insect is often misidentified as looper due to the looping motion of small larvae. This mistaken identity can be expensive. High rates of pyrethroids and other insecticides are often wasted on cloverworms misidentified as loopers.

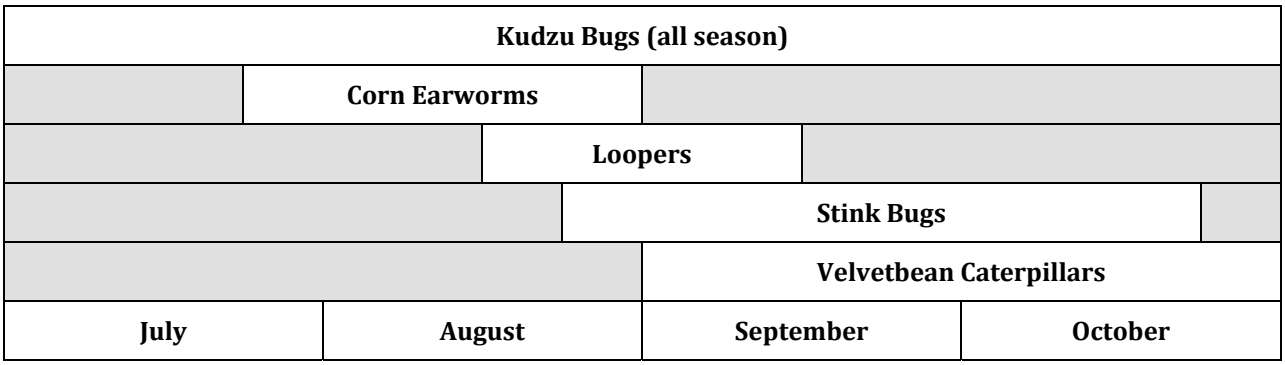
Stink Bugs. Green or brown shield-shaped insects as adults, immatures with same general shape, but no wings; mainly an August-September problem; mostly southern Coastal Plain. Stink bug damage is much less obvious than worm damage but usually more costly. Stink bug feeding causes shriveled seed with reduced germination and can cause small pods to abort.

Lesser Cornstalk Borer. Green-blue or purple-banded worm, up to three-quarters of an inch long; found at soil surface or tunneled into stem; body twitches vigorously when touched; builds a sand tube often found attached to the stem. Can be serious pest during drought stress, particularly on soils with a sandy surface. Burning and disking of wheat stubble prior to planting increases lesser cornstalk borer problems. Reduced tillage reduces lesser cornstalk borer damage. This pest destroys soybean stands by girdling or tunneling into seedlings. The problem is usually misdiagnosed as poor germination or stand loss caused directly by drought stress. The preventative treatment listed under control can protect stands in high-risk situations.

Soybean (*Dectes*) Stem Borer. Pale gray adults with long black and gray banded antennae. Larvae are cream-colored legless grubs that tunnel stems of soybeans and other hosts (ragweed, cocklebur, etc.). Larval stage is injurious to soybean by tunneling mainstems, producing seriously damaged plants and significant yield loss when infestation is early, resulting in lodged or cut plants. Associated with repetitive monoculture soybean, so crop rotation helps tremendously with prevention. Insecticide sprays are ineffective in controlling larvae or adults, and cultural practices involving crop destruction and land preparation (i.e. disking, deep plowing) are primary modes of control.

Kudzu Bugs. Kudzu bug adults grow to about the same size as adult lady beetles. They have a small, almost square-like appearance, measure approximately one-fourth inch long, and have a light brown color with an olive-green hue and dark specks. Kudzu bug eggs have a light tan color and are laid in a slanting position in two-row masses. Each barrel-shaped egg has a row of spines around the operculum (lid or opening for emerging nymphs). When immature insects hatch from the eggs, they have an orange color and remain in close proximity to the egg mass for a short time before dispersing. As nymphs grow, they take on a paler green color and a very "hairy" appearance, particularly in the late immature stages. When large numbers of adults and/or nymphs exist together, the species has a very distinct odor that can be quite strong, often to the point of being useful in detecting their presence before visually confirming it.

Timing of major soybean pest infestations South Carolina



CHEMICAL AND RATE SELECTION

See the following section for insecticide recommendations. A rate range is usually given for pest control. Factors that influence the required rate are pest size, pest density, plant size, temperature, and application method. The higher rates generally are needed for combinations of heavy populations, larger insects, dense plant canopy, extreme temperatures (95 degrees F), and aerial application.

Use of broad-spectrum insecticides such as Lannate can result in retreatment for late-season velvetbean caterpillar outbreaks. In areas with annual velvetbean caterpillar problems, growers should consider adding Dimilin to corn earworm, stink bug, or boron treatments to prevent retreatment.

SOYBEAN INSECT CONTROL

CORN EARWORM & GREEN CLOVERWORM* (Pyrethroids/Non-Pyrethroids)
BEAN LEAF BEETLE, THREECORNERED ALFALFA HOPPER, & JAPANESE BEETLE (Pyrethroids)

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
beta-cyfluthrin **(R)**		0.013-0.022		12 hr	45 d	Pyrethroids provide residual activity for VBC. Defoliation should not exceed 15-20% after mid-bloom or 30% before mid-bloom. Consider population size, canopy density, and temperature in selecting rate. After pods appear, treat for 2 or more large (>0.5 in) CEW per row ft. *Use low rates for GCW that infrequently require control. Treat for TCAH when stand is threatened, at 3 per row ft, or more than several per sweep.
Baythroid XL 1 EC	1.6-2.8 oz		45.7-80			
lambda-cyhalothrin **(R)**		0.0156-0.026		24 hr	30 d	
Karate Z 2.08 CS	0.96-1.6 oz		80-133			
Warrior 1 CS	1.92-3.2 oz		40-66.6			
Silencer 1 EC	1.92-3.2 oz		40-66.6			
Lambda-Cy 1 EC	1.92-3.2 oz		40-66.6			
esfenvalerate **(R)**		0.03-0.05		12 hr	21 d	
Asana XL 0.66 EC	5.8-9.6 oz		13-22			
gamma-cyhalothrin **(R)**		0.0075-0.0125		24 hr	30 d	
Declare 1.25 CS	0.77-1.28 oz		100-166			
zeta-cypermethrin **(R)**		0.0175-0.025		12 hr	21 d	
Mustang Max 0.8 EC	2.8-4.0 oz		32-45.7			
zeta-cypermethrin **(R)** + bifenthrin **(R)**		0.025-0.06		12 hr	21 d	
Hero 1.24 EC	2.6-6.1 oz		21-49.2			
bifenthrin **(R)**		0.04-0.1		12 hr	18 d	
Discipline 2 EC	2.6-6.4 oz		20-50			
Brigade 2 EC	2.6-6.4 oz		20-50			
Fanfare 2 EC	2.6-6.4 oz		20-50			
Bifenture 2 EC	2.6-6.4 oz		20-50			
Product (non-pyrethroids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	
indoxacarb		0.054-0.11		12 hr	21 d	
Steward 1.25 EC	5.6-11.3 oz		11.3-22.8			
spinosad				4 hr	28 d	
Tracer 4 SC (phased out)	1.5-2.0 oz	0.047-0.0625	64-85			
Blackhawk 36 WG	1.7-2.2 oz	0.038-0.05	-			
methomyl **(R)**		0.225-0.45		48 hr	14 d	
Lannate 2.4 LV	0.75-1.5 pt		5.3-10.7			
carbaryl		0.75-1.25		12 hr	21 d	
Sevin 80 S	0.94-1.56 lb		-			
Sevin XLR Plus	0.75-1.25 qt		3.2-5.33			
Sevin 4 F	0.75-1.25 qt		3.2-5.33			
flubendiamide		0.0625-0.094		12 hr	14 d	Can use until supply gone
Belt 4 SC	2.0-3.0 oz		42.6-64			
chlorantraniliprole		0.047-0.067		4 hr	21 d	5-d interval/ application
Prevathon 0.43 SC	14.0-20.0 oz		6.25-9.1			
methoxyfenozide/spinetoram		0.094-0.15		4 hr	28 d	
Intrepid Edge 3	4.0-6.4 oz		20-32			Pre-mixed

THRIPS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
acephate		0.28-0.5		24 hr	14 d	Treat only when stand is threatened
Orthene/Acephate 97	4.6-8.0 oz		-			
Orthene/Acephate 90	5.0-8.96 oz		-			

GRASSHOPPERS

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
beta-cyfluthrin **(R)**		0.016-0.022		12 hr	45 d	Grasshoppers can be a frequent problem on soybeans in reduced tillage systems. Eggs are deposited in the soil in pods and are not destroyed in minimum tillage. Re-infestation occurs from field edges and from eggs hatching in fields. OPs and pyrethroids work well on small grasshoppers at medium rates, but higher rates are needed for larger species. Dimilin, an insect growth regulator (IGR), works only on immatures and should be considered in minimum-tillage fields with a history of problems.
Baythroid XL 1 EC	2.0-2.8 oz		45.7-64			
lambda-cyhalothrin **(R)**		0.026-0.03		24 hr	30 d	
Karate Z 2.08 CS	1.6-1.92 oz		66.6-80			
Warrior 1 CS	3.2-3.84 oz		33.3-40			
Silencer 1 EC	3.2-3.84 oz		33.3-40			
Lambda-Cy 1 EC	3.2-3.84 oz		33.3-40			
esfenvalerate **(R)**		0.03-0.05		12 hr	21 d	
Asana XL 0.66 EC	5.8-9.6 oz		13-22			
gamma-cyhalothrin **(R)**		0.0125-0.015		24 hr	30 d	
Declare 1.25 CS	1.28-1.54 oz		83-100			
zeta-cypermethrin **(R)**		0.02-0.025		12 hr	21 d	
Mustang Max 0.8 EC	3.2-4.0 oz		32-40			
bifenthrin **(R)**		0.04-0.1		12 hr	18 d	
Discipline 2 EC	2.6-6.4 oz		20-50			
Brigade 2 EC	2.6-6.4 oz		20-50			
Fanfare 2 EC	2.6-6.4 oz		20-50			
Bifenture 2 EC	2.6-6.4 oz		20-50			
zeta-cypermethrin **(R)** + bifenthrin **(R)**		0.025-0.06		12 hr	21 d	
Hero 1.24 EC	2.6-6.1 oz		21-49.2			
Product (non-pyrethroids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	
acephate		0.28-0.5		24 hr	14 d	
Orthene/Acephate 97	4.6-8.0 oz		-			
Orthene/Acephate 90	5.0-8.96 oz		-			
carbaryl		0.75-1.25		12 hr	21 d	
Sevin 80 S	0.94-1.56 lb		-			
Sevin XLR Plus	0.75-1.25 qt		3.2-5.33			
Sevin 4 F	0.75-1.25 qt		3.2-5.33			
chlorpyrifos **(R)**		0.23-1.0		24 h	28 d	
Lorsban 4 E	1.0-2.0 pt	(0.5-1.0)	4-8			
Chlorpyrifos 4 E	1.0-2.0 pt	(0.5-1.0)	4-8			
Nufos 4 E	1.0-2.0 pt	(0.5-1.0)	4-8			
Lorsban Advanced 3.755	0.5-1.0 pt	(0.23-0.47)	8-16			
diflubenzuron		0.03125		12 hr	21 d	Effective on nymphs only
Dimilin 2 L **(R)**	2.0 oz		64			

SPIDER MITES

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
dimethoate		0.5		48 hr	21 d	Can be a problem in drought stress
Dimethoate 4 EC	1.0 pt		8			

VELVETBEAN CATERPILLAR

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
beta-cyfluthrin **(R)**		0.0125		12 hr	45 d	VBC can occur in high numbers but is easily controlled. Use higher rates for high populations. Significant defoliation can be caused by 4-6 large VBC per row ft, and pod clipping can occur after defoliation. Treat when defoliation exceeds 15% after mid-bloom and at 30% before mid-bloom. Pyrethroids can provide extended residual control of VBC. Dimilin is a preventative treatment for high-risk areas.
Baythroid XL 1 EC	1.6 oz		80			
lambda-cyhalothrin **(R)**		0.0156		24 hr	30 d	
Karate Z 2.08 CS	0.96 oz		133			
Warrior 1 CS	1.92 oz		66.6			
Silencer 1 EC	1.92 oz		66.6			
Lambda-Cy 1 EC	1.92 oz		66.6			
esfenvalerate **(R)**		0.015		12 hr	21 d	
Asana XL 0.66 EC	2.9 oz		44			
gamma-cyhalothrin **(R)**		0.0075		24 hr	30 d	
Declare 1.25 CS	0.77 oz		166			
zeta-cypermethrin **(R)**		0.0175		12 hr	21 d	
Mustang Max 0.8 EC	2.8 oz		45.7			
zeta-cypermethrin **(R)** + bifenthrin **(R)**		0.025-0.06		12 hr	21 d	
Hero 1.24 EC	2.6-6.1 oz		21-49.2			
Product (non-pyrethroids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	
methoxyfenozide		0.0625		4 hr	14 d	
Intrepid 2 F	4.0 oz		32			
diflubenzuron		0.03125-0.047		12 hr	21 d	
Dimilin 2 L	2.0-3.0 oz		42.6-64			
spinosad				4 hr	28 d	
Tracer 4 SC (phased out)	1.0-2.0 oz	0.03125-0.062	64-128			
Blackhawk 36 WG	1.1-2.2	0.025-0.05	-			
methomyl **(R)**		0.09-0.18		48 hr	14 d	
Lannate 2.4 LV	4.8-9.6 oz		13.3-26.6			
carbaryl		0.5-0.75		12 hr	21 d	
Sevin 80 S	0.5-1.0 lb		-			
Sevin XLR Plus	1.0-1.5 pt		5.33-8.0			
Sevin 4 F	1.0-1.5 pt		5.33-8.0			
flubendiamide		0.0625-0.094		12 hr	14 d	Can use until supply gone
Belt 4 SC	2.0-3.0 oz		42.6-64			
chlorantraniliprole		0.047-0.067		4 hr	21 d	5-d interval/ application
Prevathon 0.43 SC	14.0-20.0 oz		6.25-9.1			
methoxyfenozide/spinetoram		0.094-0.15		4 hr	28 d	
Intrepid Edge 3	4.0-6.4 oz		20-32			Pre-mixed

SOYBEAN LOOPER, TOBACCO BUDWORM, BEET & FALL ARMYWORM (FAW rarely a problem)

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
indoxacarb		0.054-0.11		12 hr	21 d	See CEW defoliation thresholds. It takes 6-8 large loopers per row ft to cause major defoliation. Existing stocks of Tracer. *Not for TBW.
Steward 1.25 EC	5.6-11.3 oz		11.3-22.8			
spinosad				4 hr	28 d	
Tracer 4 SC	1.0-2.0 oz	0.03125-0.062	64-128			
Blackhawk 36 WG	1.1-2.2	0.025-0.05	-			
methoxyfenozide		0.0625-0.125		4 hr	14 d	
Intrepid 2 F*	4.0-8.0 oz		16-32			

Product (cont.)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
flubendiamide Belt 4 SC	 2.0-3.0 oz	0.0625-0.094	 42.6-64	12 hr	14 d	Can use until supply gone
chlorantraniliprole Prevathon 0.43 SC	 14.0-20.0 oz	0.047-0.067	 6.25-9.1	4 hr	21 d	3-d interval/ application
methoxyfenozide/spinetoram Intrepid Edge 3	 4.0-6.4 oz	0.094-0.15	 20-32	4 hr	28 d	 Pre-mixed

STINK BUGS

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
beta-cyfluthrin **(R)** Baythroid XL 1 EC	 1.6-2.8 oz	0.013-0.022	 45.7-80	12 hr	45 d	After pods appear, treat when stink bugs reach 1 per row ft using a drop cloth or 1-2 per 10 sweeps using a sweep net. Orthene might increase chances for later problems with loopers and velvetbean caterpillars. Treat for stink bugs exceeding threshold into R7 crop stage.
lambda-cyhalothrin **(R)** Karate Z 2.08 CS Warrior 1 CS Silencer 1 EC Lambda-Cy 1 EC	 1.6-1.92 oz 3.2-3.84 oz 3.2-3.84 oz 3.2-3.84 oz	0.026-0.03	 66.6-80 33.3-40 33.3-40 33.3-40	24 hr	30 d	
gamma-cyhalothrin **(R)** Declare 1.25 CS	 1.28-1.54 oz	0.0125-0.015	 83-100	24 hr	30 d	
zeta-cypermethrin **(R)** Mustang Max 0.8 EC	 3.2-4.0 oz	0.02-0.025	 32-40	12 hr	21 d	
zeta-cypermethrin **(R)** + bifenthrin **(R)** Hero 1.24 EC	 4.0-10.3 oz	0.04-0.1	 12.4-32	12 hr	21 d	
bifenthrin **(R)** Discipline 2 EC Brigade 2 EC Fanfare 2 EC Bifenture 2 EC	 2.6-6.4 oz 2.6-6.4 oz 2.6-6.4 oz 2.6-6.4 oz	0.04-0.1	 20-50 20-50 20-50 20-50	12 hr	18 d	
alpha-cypermethrin **(R)** Fastac 0.83 EC	 3.8 oz	0.025	 33.7	12 hr	21 d	
Product (non-pyrethroids)	**Product/acre**	**Lb ai/acre**	**Acre/gal**	**REI**	**PHI**	
acephate Orthene/Acephate 90 Orthene/Acephate 97	 9.6-16.0 oz 8.0-16.0 oz	0.5-1.0	 - -	24 hr	14 d	

LESSER CORNSTALK BORER

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
chlorpyrifos Lorsban 15 G	 6.7-13.3 lb	1.0-2.0	 -	24 h	7 d	PREVENTION: Reduced tillage significantly reduces LCB damage, as does early season irrigation. AT PLANTING: Apply 8-15 oz 15G/1000 row ft (38' rows) in 6-8-inch band over row. Incorporate lightly with press wheel and drag chain or tines. RESCUE (erratic): When 10% of seedlings show damage, apply 4E in 25 gal water in 6-inch band directly at the base of plant.
chlorpyrifos **(R)** Lorsban 4 E Chlorpyrifos 4 E Nufos 4 E Lorsban Advanced 3.755	 1.0 qt 1.0 qt 1.0 qt 0.5-1.0 qt	0.47-1.0 (1.0) (1.0) (1.0) (0.47-0.94)	 4 4 4 4-8	24 h	28 d	

KUDZU BUGS

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
bifenthrin **(R)**		0.0625-0.1		12 hr	18 d	Apply insecticide when sweep-net sampling yields one nymph per sweep. If kudzu bug immatures are easily and repeatedly found on petioles and main stems during visual inspections of the canopy, treatment is likely warranted. Do not bias all sampling to border rows where initial populations build. Border treatment for initial infestations of adults limited to field edges might delay need for whole-field treatment.
Discipline 2 EC	4.0-6.4 oz		20-32			
Brigade 2 EC	4.0-6.4 oz		20-32			
Fanfare 2 EC	4.0-6.4 oz		20-32			
lambda-cyhalothrin **(R)**		0.03		24 hr	30 d	
Karate Z 2.08 CS	1.92 oz		66.6			
Warrior II 2.08 CS	1.92 oz		66.6			
Silencer 1 EC	3.84 oz		33.3			
gamma-cyhalothrin **(R)**		0.015		24 hr	30 d	
Declare 1.25 CS	1.54 oz		83			
zeta-cypermethrin **(R)**		0.025		12 hr	21 d	
Mustang Max 0.8 EC	4.0 oz		32			
zeta-cypermethrin **(R)** + bifenthrin **(R)**		0.062-0.1		12 hr	21 d	
Hero 1.24 EC	6.4-10.3 oz		12.4-20			
alpha-cypermethrin **(R)**		0.025		12 hr	21 d	
Fastac 0.83 EC	3.8 oz		33.7			
Pre-mixed products containing a pyrethroid listed here and another active ingredient with activity on kudzu bugs (see MULTIPLE PESTS – PRE-MIXED PRODUCTS below)						

MULTIPLE PESTS – PRE-MIXED PRODUCTS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
thiamethoxam/*lambda*-cyhalothrin **(R)**		0.04-0.072		24 hr	30 d	Season limit of 9 oz/acre Pre-mixed
Endigo 2.06 ZC*	2.5-4.5 oz		28.4-51.2			
imidacloprid/*beta*-cyfluthrin **(R)**		0.0656		12 hr	14 d	
Leverage 360	2.8 oz		45.7			Pre-mixed
imidacloprid/bifenthrin **(R)**		0.08-0.095		12 hr	18 or 45 d	
Brigadier 2 SC*	5.1-6.1 oz		21-25			Pre-mixed
chlorpyrifos/*lambda*-cyhalothrin **(R)**		0.226-0.78		24 hr	30 d	
Cobalt Advanced 2.63*	11.0-38.0 oz		3.4-11.6			Pre-mixed
chlorantraniliprole/*lambda*-cyhalothrin **(R)**		0.049-0.098	12.8-25.6	24 hr	30 d	Season limit of 20 oz/acre Pre-mixed
Besiege 1.25 ZC*	5.0-10.0 oz					
diflubenzuron/*lambda*-cyhalothrin **(R)**		0.07-0.0938		24 hr	30 d	
DoubleTake 3*	3.0-4.0 oz		32-42.7			Pre-mixed
methoxyfenozide/spinetoram		0.094-0.15		4 hr	28 d	
Intrepid Edge 3	4.0-6.4 oz		20-32			Pre-mixed

For control of multiple pests exceeding thresholds, including but not limited to various combinations of the following: cutworm, cabbage looper, green cloverworm, corn earworm, saltmarsh caterpillar, aphids, threecornered alfalfa hopper, velvetbean caterpillar, bean leaf beetles, grasshoppers, plant bugs, and stink bugs. Use higher rates for stink bugs, corn earworm, and grasshoppers. Use highest labeled rates for kudzu bug*.

ai = active ingredient; **(R)** = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

SOYBEAN DISEASE CONTROL

John D. Mueller, Extension Soybean Pathologist

Soybeans can be affected by diseases throughout the growing season. In general seedling diseases are only a problem in fields planted very early in the growing season when soil temperatures are low. They are especially prevalent if low soil temperatures are combined with very wet soils. Usually by mid-May seedling diseases are no longer a problem.

Seed treatment fungicides normally do a good job of controlling seedling diseases. During mid-season many leaf diseases are common on soybean. Downy Mildew, Brown Spot (Septoria Blight), Cercospora Leaf Spot and Frogeye Leaf Spot are very common and stem diseases such as Pod & Stem Blight and Anthracnose are common from midseason to harvest in wet years. Soybean Rust is active in South Carolina primarily after mid-August in most years.

Soybean varieties vary greatly in their susceptibility to diseases such as Frogeye Leaf Spot. Choosing a resistant variety is much more cost effective than fungicide applications. Fungicides are available that can help with many of these diseases. It is important to accurately identify the diseases you are trying to control as not all diseases can be controlled by all fungicides. Check the label of individual fungicides or your South Carolina Soybean Production Guide for information on accurate identification of diseases based on field symptoms.

In general South Carolina soybeans should not be sprayed for disease control until after they flower. This is true whether Soybean Rust or other diseases are the target. Wet weather increases the severity of most fungal diseases and the subsequent need for a fungicide. Spraying a fungicide in dry weather is often unnecessary. Foliar diseases tend to respond well to fungicide applications. Stem diseases such as Charcoal Rot are more difficult to control and lower stem diseases such as Red Crown Rot (CBR) and Southern Blight (White Mold) are almost impossible to control with fungicides.

FUNGICIDES AVAILABLE FOR CONTROLLING SEEDLING DISEASES ON SOYBEAN

Product	Active Ingredient	Fungi Controlled	Rate
Allegiance FL	Metalaxyl 28.35%	*Pythium spp.*	0.75 – 1.5 fl. oz. per cwt
Allegiance LS	Metalaxyl 17.7%	*Pythium spp.*	1.2 - 2.4 fl. oz. per cwt.
Apron XL	Mefenoxam 33.3%	*Pythium* spp. Phytophthora spp.	0.16 - 0.64 fl. oz. per cwt.
ApronMaxx RFC	Mefenoxam 3.46% Fludioxonil 2.31%	*Fusarium* spp. *Rhizoctonia solani Pythium* spp. *Phytophthora* spp.	1.5 fl. oz. per cwt.
ApronMaxx RTA	Mefenoxam 1.01% Fludioxonil 0.73%	*Fusarium* spp. *Rhizoctonia solani Pythium* spp. *Phytophthora* spp.	5.0 fl. oz. per cwt.
ApronMaxx RTA + Moly	Mefenoxam 1.02% Fludioxonil 0.68% Molybdenum 4.67%	*Fusarium* spp. *Pythium* spp. *Phytophthora* spp. *Rhizoctonia solani*	5.0 fl. oz. per cwt.
Bean Guard/Allegiance	Carboxin 12.5% Metalaxyl 3.75% Captan 24.45% molybdenum 11.9%	*Pythium* spp. *Rhizoctonia solani Fusarium spp.*	2.0 oz. per 60 lbs.
CruiserMaxx	Mefenoxam 1.7% Fludioxonil 1.12% +Thiamethoxam 22.6%	*Fusarium* spp., *Pythium* spp., *Phytophthora* spp. *Rhizoctonia solani*	2.95 fl. oz. per cwt.
CruiserMaxx Advanced	Mefenoxam 3.21% Fludioxonil 1.07% Thiamethoxam 21.5%	*Fusarium* spp., *Pythium* spp., *Phytophthora* spp. *Rhizoctonia solani*	3.1 fl. oz. per cwt.
CruiserMaxx Vibrance	Thiamethoxam 20.8% Mefenoxam 3.13% Fludioxonil 1.04% Sedaxane 1.04%	*Fusarium* spp., *Pythium* spp., *Phytophthora* spp. *Rhizoctonia solani*	3.22 fl. oz. per cwt.
Dynasty	Azoxystrobin 9.6%	*Pythium* spp. *Rhizoctonia solani Sclerotium rolfsii*	0.153 – 0.459 fl. oz. per cwt.
Enhance	Captan 19.55% Carboxin 20.0%	*Fusarium spp. Rhizoctonia solani Pythium* spp.	5.0 oz. per cwt.
Equation	Azoxystrobin 22.8%	*Rhizoctonia solani Sclerotium rolfsii*	0.40-0.80 fl. oz. per 1000 ft. row
EverGol Energy SB	Prothioconazole 7.18% Penflufen 3.59% Metalaxyl 5.74%	*Fusarium* spp. Pythium spp. Rhizoctonia solani	1.0 fl. oz per cwt
Evito 480 SC	Fluoxastrobin 40.3%	*Rhizoctonia solani Sclerotium rolfsii*	0.16 - 0.24 fl. oz. per 1000 ft. row

FUNGICIDES AVAILABLE FOR CONTROLLING SEEDLING DISEASES ON SOYBEAN (CONTINUED)

Product	Active Ingredient	Fungi Controlled	Rate
Headline SC fungicide	Pyraclostrobin 23.3%	*Rhizoctonia solani*	0.1 – 0.8 fl. oz. per 1000 ft. of row
Maxim 4FS	Fludioxonil 40.3%	*Fusarium* spp. *Rhizoctonia solani*	0.08 - 0.16 fl. oz. per cwt.
Mertect 340-F	Thiabendazole 42.3%	*Fusarium spp. Including F. virguliforme* *Phomopsis spp.*	0.08 – 0.16 fl. oz. per cwt.
Prevail	Carboxin 15% PCNB 15% Metalaxyl 3.12%	*Pythium* spp. *Rhizoctonia solani*	2.0 – 4.0 oz. per bushel
Priaxor	Fluxapyroxad 14.33% Pyraclostrobin 28.58%	*Rhizoctonia solani* *Fusarium* spp. suppression *Pythium* spp. suppression	0.2 to 0.6 fl. oz. per 1000 ft. row in-furrow
Ridomil Gold SL	Mefenoxam 45.3%	*Pythium* spp. *Phytophthora* spp.	0.08 - 0.28 fl. oz. /1000 ft. row in-furrow
Ridomil Gold GR	Mefenoxam 2.5%	*Pythium* spp. *Phytophthora* spp.	1.5 - 6.0 oz. per 1000 ft. of row in-furrow
Seed Shield Beans	Thiamethoxam 22.6% Mefenoxam 1.7% Fludioxonil 1.12% Azoxystrobin 0.9%	*Pythium spp.* *Phytopthora spp.* *Rhizoctonia solani* Seedborne *Phomopis* *Systemic Downy Mildew*	3.0 fl. oz. per cwt.
Trilex Flowable	Trifloxystrobin 22%	*Rhizoctonia solani*	0.32 fl. oz. per cwt
Trilex 2000	Trifloxystrobin 7.12% Metalaxyl 5.69%	*Fusarium* spp. *Pythium* spp. *Rhizoctonia solani*	1.00 fl. oz. per cwt.
Vibrance	Sedaxane 43.7%	*Rhizoctonia solani*	0.075 - 0.16 fl. oz. per cwt
Vitavax-34 Seed Treatment Fungicide	Carboxin 34%	*Rhizoctonia solani*	3 – 4 fl. oz. per cwt.
Warden RTA	Mefenoxam 2.21 % Fludioxonil 0.72%	*Pythium spp.* *Phytophthora spp.* *Fusarium spp.* *Rhizoctonia solani*	5.0 fl. oz. per cwt

Do not use treated seed for food, feed or oil purposes. Do not graze or feed livestock on forage or hay grown from treated soybean seed. All treated seed must be colored with an EPA-approved dye which imparts an unnatural color to the seed to help prevent the inadvertent use of treated seed as food for man or feed for animals.

FOLIAR FUNGICIDES FOR USE ON SOYBEAN IN SOUTH CAROLINA[1]

Product	Active Ingredient	Rate (fl. oz. /acre)	No. of appl. /year & max. (fl. oz. /acre) /year	Disease Controlled
Affiance	Azoxystrobin 9.35% Tetraconazole 7.48%	10 – 14	3 (28.7)	Rust + other diseases
Aftershock	Fluoxastrobin 40.3%	2.7 to 5.7 fl. oz.	2(11.4)	Rust + other diseases
Alto 100SL	Cyproconazole 8.9%	2.75 – 5.5	2 (11)	Rust + other diseases
Aproach	Picoxystrobin 22.5%	6 – 12	3 (36)	Rust + other diseases
Aproach Prima	Picoxystrobin 17.94% Cyproconazole 7.17%	5.0 – 6.8	2 (13.6)	Rust + other diseases
Cercobin	Thiophanate-methyl 41.3%	10.9-21.8	2(43.6)	For other diseases **Will not control rust**
CUSTODIA	Azoxystrobin 11.0% Tebuconazole 18.35%	8.6	3(25.9)	Rust + other diseases
Domark 230 ME	Tetraconazole 20.5%	4 - 5	2 (10)	Rust + other diseases
Endura	Boscalid 70.0%	3.5 - 5.5	2 (22)	Alternaria leaf spot + other diseases. **Not for rust**
Equation SC	Azoxystrobin 22.8%	6.0 – 15.5	2(92.3)	Rust + other diseases
Evito 480 SC	Fluoxastrobin 403%	2.0 - 5.7	2 (11.4)	Rust + other diseases
Evito-T Fungicide	Fluoxastrobin 18.0% Tebuconazole 25.0%	4 - 6	2 (11.4)	Rust + other diseases
Folicur 3.6 SC	Tebuconazole 38.7%	3.0 – 4.0	3 (12)	Rust + powdery mildew
Fortix	Fluoxastrobin 14.84% Flutriafol 19.30%	4.0 - 6.0	2 (12)	Rust + other diseases
Preemptor	Fluoxastrobin 14.84% Flutriafol 19.30%	4.0 - 6.0	2 (12)	Rust + other diseases
Gem RC	Trifloxystrobin 42.6%	3.0 - 3.5	3 (10.5)	Rust + other diseases
Orius 3.6 F	Tebuconazole 38.7%	3.0 – 4.0	3 (12)	Rust + powdery mildew
Tebuzol 3.6 F	Tebuconazole 38.7%	3.0 – 4.0	3 (12)	Rust + powdery mildew
Headline Fungicide	Pyraclostrobin 23.6%	6.0 – 12.0	2 (24)	Rust + other diseases
Headline SC Fungicide	Pyraclostrobin 23.3%	6.0 - 12.0	2 (24)	Rust + other diseases

FOLIAR FUNGICIDES FOR USE ON SOYBEAN IN SOUTH CAROLINA[1](Cont.)

Product	Active Ingredient	Rate (fl. oz. /acre)	No. of appl. /year & max. (fl. oz. /acre) /year	Disease Controlled
Priaxor D	Fluxapyroxad 14.33% & Pyraclostrobin 28.58% + Tetraconazole 20.5%	4.0 + 4.0	2 (8 + 8)	Rust + other diseases
Priaxor XEMIUM BRAND FUNGICIDE	Fluxapyroxad 14.33% Pyraclostrobin 28.58%	4.0 – 8.0	2 (16)	Rust + other diseases
Proline 480 SC	Prothioconazole 41.0%	2.5 - 3.0	3 (9)	Rust + Powdery mildew
Quadris Flowable	Azoxystrobin 22.9%	6 - 15.5	2 (92)	Rust + other diseases
Quadris Top SB	Azoxystrobin 18.2% Difenoconazole 11.4%	8 – 14	2 (26.5)	Rust + other diseases
Quadris Top SBX	Azoxystrobin 19.8% Difenoconazole 19.8%	7.0 – 7.5	2 (14.8)	Rust + other diseases
Quadris Xtra 280 SC	Azoxystrobin 18.2% Cyproconazole 7.3%	4.0 – 6.8	2 (13.6)	Rust + other diseases
Quilt	Azoxystrobin 7.0% Propiconazole 11.7%	14 - 20.5	2 (42)	Rust + other diseases
Topguard	Flutriafol 11.8%	7.0 – 14.0	2 (14)	Rust + other diseases
Topsin XTR2	Thiophanate-methyl 37.5% Tebuconazole 7.5%	20	See label	Rust + other diseases
TOPSIN 4.5 FL	Thiophanate-methyl 45.0%	10-20	2 (40)	Other diseases – **WILL NOT CONTROL RUST**
Topsin M WSB	Thiophanate-methyl 70.0%	0.5 – 1.0 lbs/acre	2 (2 lbs)	Other diseases – **WILL NOT CONTROL RUST**
Trivapro A Trivapro B	Bensovindiflupyr 10.27% Azoxystrobin 13.5% Propiconazole 11.7%	4.0 10.5	2 (14) 4 (42)	Rust + other diseases
Vertisan	Penthiopyrad 20.6%	10 - 30	2 (61)	Rust + other diseases
Zolera FX	Fluoxastrobin 17.76% Tetraconazole 17.76%	4.4 – 6.8	1 (6.8)	Rust + other diseases

[1]For a list of specific diseases controlled by each fungicide please see a product label.

PRODUCTS CONTAINING CHLOROTHALONIL FOR THE CONTROL OF RUST AND OTHER FOLIAR DISEASES OF SOYBEAN[1] (Cont.)

Product	Formulation	Rate per acre	Maximum total/year
Bravo Weather Stik	Flowable	16 - 32 fl. oz. (3 appl.) 24 - 36 fl. oz. (2 appl.)	96.0 fl. oz.
Bravo Ultrex	Dry Flowable	0.9 -1.4 lbs. (3 appl.) 1.4 - 2.2 lbs. (2 appl.)	5.4 lbs.
Echo 720	Flowable	16 - 32 fl. oz. (3 appl.) 24 - 40 fl. oz. (2 appl.)	96.0 fl. oz.
Echo 90DF	Dry Flowable	0.875 - 1.62 lbs. (3 appl.) 1.25 - 2.0 lbs. (2 appl.)	4.4 lbs.
Equus 720 SST	Flowable	24 - 48 fl. oz. (3 appl.) 24 - 32 fl. oz. (2 appl.)	96.0 fl. oz.
Equus DF	Dry Flowable	0.9 - 1.4 lbs. (3 appl.) 1.4 - 2.1 lbs. (2 appl.)	5.4 lbs.

[1]For a list of specific diseases controlled by each fungicide please see a product label.

SOYBEAN NEMATODE CONTROL

John D. Mueller, Extension Soybean Pathologist

Nematode-induced yield losses in South Carolina soybeans are caused primarily by Southern root-knot, soybean cyst, Columbia lance, and reniform nematodes. Soybean is an excellent host for these nematode species and often sustains significant yield losses. Sting, lesion, and peanut root-knot nematodes also cause yield losses in some fields. Use of nematicides for controlling nematodes on soybeans is often cost prohibitive. Use of a nematicide should be coupled where possible with the use of resistant varieties and in-row subsoiling or deep tillage. In many instances nematode control may require rotation to a non-host crop. Please see your South Carolina Soybean Production Guide for more in-depth information on nematode management.

NEMATICIDES AVAILABLE FOR CONTROLLING SOYBEAN NEMATODES. SEE LABELS FOR SPECIES CONTROLLED BY EACH PRODUCT.

Nematicide	Active ingredient	Rate per acre for 38 inch rows	Comments
Telone II	1,3-dichloropropene	3.0 – 6.0 gallons	Release fumigant at least 12 inches from the soil surface. Must be applied 10 – 14 days prior to planting.
Temik brand 15G Aldicarb Pesticide & Temik Brand 15G Lock'n Load Aldicarb Pesticide	Aldicarb	3.0 - 5.0 lbs.	Apply granules in a 6 – 8 inch band and immediately work into the soil or cover with soil. Plant seed into treated zone. Band may be applied over an open furrow.
AgLogic 15G	Aldicarb	7.0 lbs.	Apply a 4-6 inch band (T-band) over open seed furrow and immediately cover with soil by mechanical means
Avicta Complete Bean	Abamectin Thiamethoxam Mefenoxam Fludioxonil	3 fl. oz. 1.28 fl. oz. 0.16 fl. oz. 0.08 fl. oz. All per cwt. of seed	Application by commercial seed treaters only. It has active ingredients to control nematodes and seedling disease problems.
K-Pam	Potassium N-methyldithiocarbamate	See Label	Inject 12 inches below planting depth and seal immediately 14-21 days before planting.
Vapam HL	Sodium methyldithiocarbamate	See Label	Inject 12 inches below planting depth and seal immediately 14-21 days before planting.
AVICTA 500 FS	Abamectin	See Label	Applied only as a commercial seed treatment. Contains materials to control only nematodes.

NEMATICIDES AVAILABLE FOR CONTROLLING SOYBEAN NEMATODES. SEE LABELS FOR SPECIES CONTROLLED BY EACH PRODUCT. (Cont.)

Nematicide	Active ingredient	Rate per acre for 38 inch rows	Comments
Avicta Complete Bean	Abamectin Thiamethoxam Mefenoxam Fludioxonil	See Label	Applied only as a commercial seed treatment. Contains materials to control nematodes, seedling diseases and thrips.
PONCHO/VOTiVO	Clothiandin *Bacillus firmus* I1582	See Label	Applied only as a commercial seed treatment. Contains materials to control nematodes and thrips.
Clariva pn	Pasteuria nishizawae – Pn1	1.0 to 3.0 fl. oz. per cwt. of seed	Effective only against Soybean cyst nematode.
Clariva Complete Beans	*Pasteuria nishizawae* –PN1 Sedaxane Thiamethoxam Fludioxonil Mefenoxam	See label	Includes the nematicide Clariva pn, Cruiser Maxx Beans insecticide/fungicide and the fungicide Vibrance. The only nematode this will control is Soybean cyst nematode.

WEED CONTROL IN SUNFLOWER

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Sunflowers

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (carfentrazone) Aim 2EW	1.0-2.0 oz	0.016-0.032 lb	14	3 days	12 hours
Comments: Apply anytime before planting when weeds are small. Use a higher rate for larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution), or MSO (1-2 gal per 100 gals of spray solution). Tank mix partners include GLYPHOSATE, LIBERTY, GRAMOXONE.					
Gramoxone SL 2 E (paraquat) Paraquat 3 S	2.5-4.0 pt 1.7-2.7 pt	0.63-1.0 lb	22	None	12 hours
Comments: GRAMOXONE is a RESTRICTED USE PESTICIDE. Apply PARAQUAT prior to planting to effectively desiccate weeds for more efficient planting and reduce competition with sunflower seedlings. Add non-ionic surfactant at 2 qt/100 gallons of spray solution. Do not make more than 3 applications per year (preplant/preemergence).					
Glyphosate acid equivalent (ae) 3 lb ae/gal 4 lb ae/gal 4.17 lb ae/gal 4.5 lb ae/gal	 32-47 oz 24-46 oz 23-45 oz 22-32 oz	 0.75-1.13 lb ae	9	None	4 hours
Comments: Apply 1-2 weeks prior to planting date to control existing grass and broadleaf weeds and to reduce competition with sunflower seedlings.					
Liberty 280 SL (glufosinate)	29-36 oz	0.53-0.66 lb	10	70 days	12 hours
Comments: Spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tank-mix partners.					
Spartan Charge 3.5F (carfentrazone + sulfentrazone)	3.75-7.75 fl oz	 0.016-0.028 lb + 0.16-0.25 lb	 14 14	None	12 hours
Comments: Apply SPARTAN CHARGE prior to 1-2 weeks prior to planting or up to 3 days after planting sunflowers. For an increased weed spectrum, tank mix with GLYPHOSATE, LIBERTY, or PARAQUAT. Add SPARTAN CHARGE to the spray tank water first.					

Weed and Cover Crop Response to Burndown/Preplant Herbicides[1]

	Aim	Glyphosate	Liberty	Paraquat
bluegrass, annual	G	F	P	G
chickweed, common	G	F	E	E
dandelion	P	P	FG	P
dock, curly	P	PF	G	F
eveningprimrose, cutleaf	GE	PF	G	F
geranium, Carolina	GE	FG	GE	GE
henbit/deadnettle	E	F	G	G
horseweed	G	E	GE	F
lambsquarters, common	G	GE	FG	FG
peanut, volunteer	F	FG	E	P
radish, wild	G	PF	GE	G
ryegrass, Italian	F	G	P	FG
vetch	GE	F	GE	G
wheat	F	E	F	F

[1]Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 50 to 80%; P = poor control, < 50%; --- = Insufficient Data.

Preplant Incorporated (PPI) and Preemergence (PRE) Herbicides for Weed Management in Sunflowers

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Dual Magnum 7.62SC (*s*-metolachlor)	1.0-1.33 pt	0.96-1.27 lb	15	None	24 hours
Comments Control of annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil. Can also be applied preemergence surface application (after planting, prior to crop emergence). Provides early season yellow and purple nutsedge suppression.					
Prowl H2O 3.8EC (pendimethalin)	1.5 pt	0.71 lb	3	21 days	24 hours
Prowl 3.3 EC	1.7 pt				
Comments: Control of annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil within 7 days of application. Can also be applied preemergence (after planting, prior to crop emergence).					
Sonalan HFP 3EC (ethalfluralin)	1.5-2.0 pt	0.6-0.75 lb	3	None	24 hours
Comments: Controls annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil within 48 hours of application.					

Preplant Incorporated (PPI) and Preemergence (PRE) Herbicides for Weed Management in Sunflowers (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Spartan 4F (sulfentrazone)	3.0-6.0 fl oz	0.094-0.188 lb	14	None	12 hours
Comments: Apply SPARTAN and shallowly incorporate up to 2 inches (Do not incorporate more than 2 inches). SPARTAN can cause sunflower injury at high rates on light soil. SPARTAN can also be applied preemergence (at planting or up to 3 days after planting, but prior to crop emergence). Apply SPARTAN a minimum of 7-14 days before planting on coarse textured soils. Do not apply to soils classified as SANDS with less than 1.0% organic matter. Do not apply more than 8.0 fl oz/A of SPARTAN per growing season.					
Spartan Charge 3.5F (carfentrazone + sulfentrazone)	3.75-7.75 fl oz	0.016-0.028 lb + 0.16-0.25 lb	14 14	None	12 hours
Comments: Apply SPARTAN CHARGE as a broadcast surface application at planting or up to 3 days after planting sunflowers (do not incorporate). Properly closed seed furrows are required when applying at planting time or before seed germination. Tank mix with a grass herbicide for broader spectrum control. Do not apply SPARTAN CHARGE after crop emergence or if the seedling is close to the soil surface as crop response may occur. Do not apply more than 10.2 fl oz SPARTAN CHARGE per 12 month period. Do not use on soils classified as sands, which have less than 1% organic matter.					
Treflan 4EC (trifluralin)	1.0-1.5 pt	0.5-0.75 lb	3	60 days	12 hours
Comments: Controls annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil within 48 hours of application.					

Postemergence (POST) Herbicides for Weed Management in Sunflowers

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Assure II 0.88E (quizalofop)	5-12 fl oz	0.034-0.069 lb	1	60 days	12 hours
Comments: Apply ASSURE II 7-8 oz/A over-the-top sunflowers to control annual grasses up to 6" tall. For control of rhizome johnsongrass, apply 5 oz of Assure II when johnsongrass is 10-24" tall and then retreat with 5 oz when regrowth reaches 6-10" tall. For bermudagrass control, apply 10-12 oz/A at 3" tall (up to 6" runners). Wait a minimum of 7 days between applications to allow for adequate regrowth. Add crop oil concentrate at 1 gal/100 gallons or nonionic surfactant at 1 qt/100 gallons of spray mixture. Do not exceed 18 oz/A in a growing season. Do not apply ASSURE II after pod set. **Rainfast interval = 1 hour.**					
Beyond 1AS (imazamox)	4.0 fl oz	0.031 lb	2	None	4 hours
Comments: USE ONLY ON CLEARFIELD SUNFLOWER VARIETIES. For best results, use a foundation soil applied herbicide at or before planting. Apply BEYOND to sunflowers from the 2- to 8-leaf growth stage before broadleaf weeds exceed 3 inches in height. Add non-ionic surfactant at 2 qt per 100 gal of spray solution plus liquid nitrogen at 1-2 qt/A or ammonium sulfate at 1.5-3 lb/A. **Rainfast interval = 1 hour.**					

Postemergence (POST) Herbicides for Weed Management in Sunflowers

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Poast 1.5E (sethoxydim)	1.0-1.5 pt	0.19-0.28 lb	1	75 days	12 hours
Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A up to 25" tall. A second 1.0 pt/A treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A, and then apply a second application of 1.0 pt/A to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or crop oil concentrate at 2 pt/A. Include liquid nitrogen at 4-8 pt/A or ammonium sulfate at 2.5 lb/A for enhanced crabgrass activity. Consult label for tank mix partners. Do not apply more than 2.5 pt/A per season. Do not use POAST on inbred sunflower lines grown for seed. **Rainfast interval = 1 hour.**					
Select 2EC (clethodim)	6.0-16.0 fl oz	0.09-0.25 lb	1	70 days	24 hours
SelectMAX 0.97EC	12.0-32.0 fl oz				
Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 8 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. A second 6 oz/A (6-18 oz/A SELECT MAX) treatment may be applied to control regrowth. For bermudagrass, treat 6" runners with 8 oz/A (16 oz/A SELECT MAX), and then apply a second application of 8 oz/A (16 oz/A SELECT MAX) to 6" re-growth. Add a nonionic surfactant at 0.25% v/v or crop oil concentrate at 1 qt/A plus ammonium sulfate at 2.5 lb/A for enhanced johnsongrass and volunteer corn activity. Consult label for tank mix partners. **Rainfast interval = 1 hour.**					

Hooded Sprayer Herbicides for Weed Management in Sunflowers

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC (carfentrazone)	1.0-2.0 fl oz	0.016-0.032 lb	14	---	12 hours
Aim 1.9EW					
Comments: Apply AIM using a hooded or shielded sprayer toward the base of the plant to avoid contact with the sunflower foliage or green tissue. Controls velvetleaf, annual morningglory, and pigweeds. Add 1 qt of nonionic surfactant per 100 gallons of spray solution. Do not apply more than 4.1 fl oz/A of AIM in-season as a row-middle application. Do not apply more than 6.1 fl oz/A of AIM from all applications per growing season. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**					
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22 fl oz	0.75 lb ae			
Comments: Apply GLYHOSATE to row middles using hooded or shielded sprayer that prevents spray contact with sunflower foliage or green tissue. Do not apply more than a combined 22 fl oz/A of GLYPHOSATE from preplant through hooded sprayer applications. Do not graze or feed treated sunflower forage following application of GLYPHOSATE. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**					

Harvest Aids for Sunflowers

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Glyphosate acid equivalent (ae)			9	7 days	4 hours
4.5 lb ae/gal	22 fl oz	0.75 lb ae			
Comments: Apply GLYHOSATE when sunflowers are physiologically mature indicated by the backsides of the flowers are yellow and bracts are turning brown, and seed moisture is less than 35%. Do not exceed 22 fl oz/A of GLYPHOSATE for a preharvest application. Do not graze or feed treated sunflower forage following application of GLYPHOSATE. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**					
Gramoxone SL 2.0S (paraquat)	1.2-2.0 pt	0.3-0.5	22	7 days	24 hours
Parazone 3.0S	0.8-1.3 pt				
Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply PARAQUAT a minimum of 10 gallons of spray per acre (5 gallons by air) when sunflowers are physiologically mature (when seed is 35% moisture or less). Add non-ionic surfactant at 2 qt/100 gallons of spray solution. Do not make more than 2 applications per year (harvest aid). Do not graze treated areas or feed treated forage to livestock.					
Valor SX (flumioxazin)	1.5-2.0 oz	0.032-0.064 lb	14	5 days	12 hours
Valor EZ 4SC	1.5-2.0 fl oz				
Comments: Apply VALOR SX when sunflowers are physiologically mature (when seed is 35% moisture or less). To ensure thorough coverage, use a minimum of 15 gallons per acre. Add methylated seed oil which contains at least 15% emulsifiers and 80% oil at 1 qt/A. A spray grade nitrogen source (ammonium sulfate at 2-2.5lb/A or a 28-32% nitrogen solution at 1-2 qt/A) may be added to the spray mixture along with methylated seed oil to enhance dessication. Tank mixing GLYPHOSATE or PARAQUAT will increase the control of emerged weeds and aid in harvest of sunflowers.					

Weed Response to Herbicides for Sunflower Weed Management[1]

	PPI	PPI or PRE			PRE	POSTEMERGENCE				HOODED	
	Sonalan/Treflean	Dual Magnum	Prowl	Spartan	Spartan Charge	Assure II	Beyond	Poast	Select/MAX	Aim	Glyphosate
amaranth, Palmer[2]	G[2]	FG	FG[2]	G	G	P	P[2]	P	P	G	E[2]
anoda, spurred	P	P	P	G	G	P	F	P	P	F	GE
Bermudagrass	P	P	P	P	P	GE	P	FG	G	P	G
cocklebur, common	P	P	P	G	G	P	E	P	P	GE	E
crabgrass	E	E	F	P	FG	E	FG	GE	GE	P	E
croton, tropic	P	P	P	G	---	P	P	P	P	G	GE
crowfootgrass	E	E	E	P	F	E	FG	FG	G	P	E
goosegrass	E	E	PF	P	FG	E	NP	GE	GE	P	E
johnsongrass, rhizome	P	P	P	P	P	G	G	G	GE	P	E
lambsquarters, common	GE	F	G	G	E	P	G	P	P	P	E
morningglory spp.	P	P	P	G	E	P	FG	P	P	G	FG
nutsedge, purple	P	P	P	G	E	P	P	P	P	P	G
nutsedge, yellow	P	FG	P	G	E	P	P	P	P	P	FG
panicum, fall	G	G	F	P	FG	E	FG	GE	E	P	E
panicum, Texas	G	PF	PF	P	F	E	FG	GE	GE	P	E
pigweeds	E	E	E	E	E	P	E	P	P	E	E
pusley, Florida	E	G	G	G	FG	P	---	P	P	G	FG
ragweed, common	P	PF	P	P	P	P	F	P	P	E	GE
sandbur	E	FG	G	P	PF	E	FG	G	G	P	E
senna, coffee	P	P	P	G	---	P	P	P	P	FG	GE
sesbania, hemp	P	P	P	P	---	P	---	P	P	G	PF
sicklepod	P	P	P	P	P	P	P	P	P	P	E
sida, prickly	P	P	P	P	P	P	G	P	P	G	G
signalgrass, broadleaf	GE	FG	GE	P	F	E	FG	GE	GE	P	E
smartweed, Pennsylvania	---	P	P	P	P	P	---	P	P	G	E
starbur, bristly	P	P	P	---	---	P	---	P	P	GE	GE
velvetleaf	P	P	P	E	E	P	E	P	P	G	GE

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 50 to 80%; P = poor control, < 50%; --- = Insufficient Data.
[2]Will not control biotypes resistant to this class of chemistry

WEED CONTROL IN TOBACCO

Mike Marshall, Extension Weed Specialist

Preplant Incorporated Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Command 3ME (clomazone)	2.0-2.67 pt	0.75-1.0 lb	13	65 days	12 hours
Comments: Apply COMMAND to the soil surface as a broadcast spray and incorporate using shallow tillage (less than 2 inches). Excellent control of prickly sida and annual grasses. Good control of ragweed. See label for other restrictions and drift control measures. COMMAND may persist and cause injury to small grain cover crops, see label for details. COMMAND may be applied up to 7 days after transplanting.					
Devrinol 2EC (napropamide)	2.0-4.0 qt	1.0-2.0 lb	15	70 days	24 hours
Devrinol 50DF	2.0-4.0 lb				
Comments: Apply DEVRINOL preplant incorporated by shallow disking. Controls pigweed, ragweed and other broadleaf weeds. Use the higher rate for fields with a history of heavy weed infestations. Will not control morningglories. Do not exceed 2.0 lb ai/A DEVRINOL per cropping season. Do not apply DEVRINOL more than once per cropping season.					
Prowl H2O 3.8EC (pendimethalin)	2.0 pt	0.95 lb	3	---	24 hours
Prowl 3.3E	2.4 pt	0.99 lb			
Comments: Apply PROWL broadcast on the soil surface and incorporate up to 60 days before transplanting. Increase rate where weed pressure is heavy. Controls small seeded annual grasses and broadleaf weeds.					
Tillam 6E (pebulate)	2.67 qt	6.0 lb	8	---	12 hours
Comments: Apply TILLAM and incorporate immediately to prevent evaporation of TILLAM with a tandem disk set to cut 6" deep. For best results, run the tandem disk in two different directions (cross disk). Drag with a spike tooth harrow or cultipack to help seal TILLAM in soil. Provides good control of most grasses and nutsedge. TILLAM is not persistant in the soil and weeds germinating late in the season will not be controlled.					
Tillam 6E (pebulate)	2.67 qt	6.0 lb	8	70 days	12 hours
+	+				
Devrinol 2EC (napropamide)	2.0-4.0 qt	1.0-2.0 lb	15		
Devrinol 50DF/DF-XT	2.0-4.0 lb				
Comments: Apply DEVRINOL + TILLAM preplant incorporated by shallow disking. This combination will provide control of nutsedge and annual grasses and broadleaves. Apply up to 3 weeks before transplanting. Do not apply more than 1 gallon/A of DEVRINOL 2EC per season. Do not make more than 1 application of DEVRINOL per season. Use lower rate on coarse-textured soils.					

Pretransplant (Surface Applied) Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Spartan 4F (sulfentrazone)	6.0-8.0 fl oz	0.19-0.25 lb	14	---	12 hours
Comments: Apply SPARTAN 4F to the soil surface following land preparation from 14 days up to 12 hours before transplanting. If beds are formed before transplanting, the top of the beds should be knocked down prior to application of SPARTAN. Sprayer calibration and good agitation are essential with application of SPRATAN. Avoid excessive overlap of spray swaths. Excellent control of morningglory, pigweed, lambsquarters and yellow nutsedge. Do not apply SPARTAN over the top of transplanted tobacco as crop injury may occur. Tank mix with COMMAND or PROWL for improved grass control. Do not apply more than 12 fl oz/A of SPARTAN per 12-month period. Do not apply SPARTAN to soils classified as sands with less than 1.0% organic matter. Do not use SPARTAN in tobacco seeding beds or greenhouses.					
Spartan Charge 3.5F (carfentrazone + sulfentrazone)	5.7-10.2 fl oz	0.016-0.028 lb + 0.16-0.25 lb	14 14	---	12 hours
Comments: Apply SPARTAN CHARGE to the soil surface following land preparation from 14 days up to 12 hours before transplanting. If beds are formed before transplanting, the top of the beds should be knocked down prior to application of SPARTAN CHARGE. SPARTAN CHARGE will provide postemergence activity on weeds (less than 3 inches in height) present at the time of application. Sprayer calibration and good agitation are essential with application of SPRATAN CHARGE. Avoid excessive overlap of spray swaths. Excellent control of morningglory, pigweeds, lambsquarters, and yellow/purple nutsedge. Do not apply SPARTAN CHARGE over the top of transplanted tobacco as crop injury may occur. Tank mix with COMMAND or PROWL for improved grass control. Do not apply more than 15.2 fl oz/A of SPARTAN CHARGE per 12-month period. Do not apply SPARTAN CHARGE to soils classified as sands with less than 1.0% organic matter.					

At-Transplant Postemergence Broadcast Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Command 3ME (clomazone)	2.0-2.67 pt	6.0 lb	13	65 days	12 hours
Comments: Apply COMMAND over-the-top of transplants immediately after setting to provide soil residual control of small seeded annual grasses and broadleaves. Use the higher rate for fields with a history of weed problems. If possible, irrigate with a half inch of water if no rainfall occurs within 3 to 5 days.					
Devrinol 50DF/DF-XT (napropamide)	2.0-4.0 lb	1.0-2.0 lb	15	70 days	24 hours
Devrinol 2EC	2.0-4.0 qt				
Comments: Apply DEVRINOL over-the-top of transplants immediately after setting to provide soil residual control of small seeded annual grasses and broadleaves. Use the higher rate for fields with a history of weed problems. If rainfall does not occur within 5 days, shallowly incorporate or irrigate with sufficient water to wet soil to a depth of 2 to 4 inches. Do not apply more than 4 lb DEVRINOL per season.					

Post-Transplant Postemergence Directed Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
Aim 2EC/1.9EW (carfentrazone)	0.8-1.5 fl oz	0.0125-0.024 lb	14	6 days	12 hours
Comments: Apply AIM using a shielded or hooded sprayer to weeds that are emerged and actively growing before layby (less than 3 inches in height). Add crop oil concentrate (COC) at 1 gal per 100 gal of spray solution. Coverage is essential for maximum efficacy on target weeds. Do not apply AIM when conditions favor drift. Do not allow spray to contact tobacco foliage or green stem tissue as severe crop injury may occur. Do not apply more than 3.06 fl oz AIM per acre per season. **Rainfast interval = 6 hours.**					
Devrinol 50DF (napropamide)	2.0 lb	1.0 lb	15	70 days	12 hours
Devrinol DF-XT					
Devrinol 2EC	4 qt				
Comments: Apply following last cultivation. Direct spray into row middles using drop nozzles. Provides only residual control. No activity on emerged weeds. If rainfall does not occur within 5 days, shallowly incorporate or irrigate with sufficient water to wet soil to a depth of 2 to 4 inches. Do not apply more than 4 lb/A of DEVRINOL per season.					
Poast 1.5E (sethoxydim)	1.0-1.5 pt	0.19-0.28 lb	1	42 days	12 hours
Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A up to 25" tall. A second 1.0 pt/A treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A, and then apply a second application of 1.0 pt/A to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or COC 2 pt/A plus UAN at 4-8 pt/A or AMS at 2.5 lb/A. Do not apply more than 4.0 pt/A per season of POAST. **Rainfast interval = 1 hour.**					
Prowl H2O 3.8EC (pendimethalin)	1.5-2.0 pt	0.71-0.95 lb	3	N/A	24 hours
Prowl 3.3 EC	1.8-2.4 pt	0.74-0.99 lb			
Comments: Apply 4 to 6 weeks after transplanting in a 16 to 24-inch directed band between crop rows. Spray should not contact the tobacco leaves. Use the higher product rate where weed pressure is heavy. Controls most annual grasses and pigweeds. No activity on emerged weeds.					

Weed Response to Herbicides for Tobacco Weed Management[1]

	PRE-TRANSPLANT							POST-TRANSPLANT					
	PPI					PRE		AT-TP		LAYBY DIRECTED			
	Command	Devrinol	Prowl	Tillam	Devrinol + Tillam	Spartan	Spartan Charge	Command	Devrinol DF-XT	Poast	Aim	Devrinol DF-XT	Prowl
cocklebur, common	F	P	P	P	P	FG	FG	F	P	P	G	P	P
crabgrass	E	E	E	E	E	FG	FG	E	E	E	P	E	E
crowfootgrass	E	E	E	E	E	F	F	G	E	E	P	E	E
goosegrass	G	E	G	G	G	FG	FG	G	E	E	P	E	E
Johnsongrass (seedling)	G	F	G	G	G	F	F	F	F	E	P	F	G
lambsquarters	G	G	G	G	G	E	E	FG	G	P	E	G	G
morningglory spp.	P	P	P	P	P	E	E	P	P	P	GE	P	P
nutsedge, purple	P	P	P	P	P	E	E	P	P	P	P	P	P
nutsedge, yellow	P	P	P	F	F	E	E	P	P	P	P	P	P
panicum, fall	G	G	G	G	G	FG	FG	G	G	P	P	G	G
panicum, Texas	G	---	G	P	P	F	F	G	---	G	P	---	G
pigweeds	P	G	G	G	G	E	E	P	G	P	E	G	GE
pusley, Florida	F	E	G	G	E	FG	FG	FG	G	P	---	E	E
ragweed, common	G	F	P	P	G	P	P	F	F	P	F	F	P
sandbur	F	---	G	G	G	PF	PF	F	---	G	P	---	G
sicklepod	P	P	P	P	P	P	P	P	P	P	P	P	P
sida, prickly	E	P	P	P	F	P	P	G	P	P	P	P	P
smartweed	G	P	P	P	P	E	E	G	P	P	E	P	PF

[1]***Key to Response Ratings***: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

TOBACCO INSECT CONTROL

Francis P. F. Reay-Jones, Extension Entomologist

Integrated pest management (IPM) is the ecological approach to pest control. It uses ALL suitable techniques to reduce pests below economic levels. It is not the intention of IPM to do away with chemicals. If anything, IPM is designed to protect chemicals from being lost or becoming ineffective.

When insect pest populations reach economic threshold levels, control measures must be taken. The ultimate line of defense against insect enemies is the use of chemicals. These control costs can be very expensive, but the cost of not controlling could be total crop destruction. With IPM, when chemicals are used, it is because they are necessary; facts replace hunches.

IPM is needed even in high cash crops such as tobacco. Indiscriminate use of insecticides destroys beneficial insects. This can cause minor or secondary pests to become major pests and major pests to reach serious levels earlier. Overuse of insecticides may also contribute to a resistance buildup by the pests and make control even harder.

In order to reduce selection pressure on any given active ingredient, we recommend that growers avoid using insecticides with the same mode of action on consecutive generations of a pest if multiple applications are required during a growing season. Rotation among insecticides with different modes of action is recommended. This will help to maintain the efficacy of labeled products. To help with selection of insecticides, modes of action of insecticides are indicating in the recommendations below using the classification defined by the Insecticide Resistance Action Committee (http://www.irac-online.org). A different number indicates a different mode of action.

Natural Control - This includes weather, beneficial insects, diseases, etc., and results in the death of most insect pests (sometimes as many as 95-97%). Perhaps as many as 50%, or even more, of the potential insect pests are destroyed by beneficial insects before they can do much damage to tobacco. Beneficial insects are very important.

Economic Threshold - This is a level at which a treatment would be profitable and a decision to treat should be made. Economic thresholds may be affected by such things as location, size of insects, presence of beneficials, time of growing season, stage of growth, and the size and condition of the tobacco plant. Economic thresholds are continually changing. When in doubt, consult with your county Extension agent.

Current economic thresholds are:

Tobacco budworms - Treat when four or more plants out of 100 (4%) are infested with budworms during the first 4 weeks after transplanting. After the fourth week and until plants have buttoned, treat when 10 or more plants out of 100 (10%) are infested. When using CU-263, you may be able to wait a little longer before treatment.

Tobacco hornworms - Treat when 10 or more worms (without parasite cocoons) are found per 100 plants (10%). Worms having white parasite cocoons eat much less, and more of these can be tolerated before treatment is required.

Aphids - Treat when 10% of the plants checked have 50 or more live aphids on at least one leaf.

Flea beetles - Treat when there is an average of three flea beetles per plant early in the season, when the tobacco is small, or an average of 20 flea beetles per plant late in the season, when the tobacco is large. Flea beetles are normally a problem only early in the season (shortly after transplanting) and late in the season (when the harvest of lower leaves moves the flea beetles up the stalk).

Cutworms - Treat when 10% of the plants checked show cutworm damage.

Scouting - Scouting tobacco for various pests was part of the Tobacco IPM program that began in Dillon County in 1979. The program expanded to Florence and Horry counties in 1982 and to Marion County in 1983. Private scouting began in 1984, and continues. Ultimately, we hope that all tobacco in this state will be scouted at least once a week for all crop pests, by trained scouts or by the growers.

THRIPS

Thrips are responsible for the transmission of tomato spotted wilt virus (TSWV) in tobacco. Thrips are very tiny insects, barely visible with the naked eye. Although there are many different kinds of thrips found on tobacco, only three of those species are capable of transmitting the disease. One of those, *Frankliniella fusca* (the tobacco thrips), is the most common thrips found on tobacco.

Transmission of the disease seems to be most common during a fairly short period of time early in the season. Insecticide applications to control the thrips seem to provide very little help in controlling the disease. By the time that the insecticide kills the thrips, they have already transmitted the disease. The application of Admire (or generic brands of imidacloprid) or Platinum insecticides prior to transplanting does provide some suppression of the disease.

APHIDS

For several years now, we have been seeing fewer green aphids and more red aphids, with the latter being more difficult to control. Some taxonomic work suggested that the aphid that we have had on tobacco for the past few decades was not the green peach aphid, *Myzus persicae*. A new species, the tobacco aphid (*Myzus nicotianae)*, was described. We have now come full circle. Other taxonomists have looked at the situation and come to the conclusion that these are both the same species, the green peach aphid. The green peach aphid does come in both a red and green color form, with the red generally being more difficult to control.

Aphids secrete a sugary substance known as honeydew. Honeydew is sticky, and a perfect site for the development of sooty mold. Once honeydew and sooty mold are present on the leaves, they are nearly impossible to get off. As aphids molt, they leave their cast skins behind. I have received numerous calls from growers (by the way of the county agents) who complained of getting poor control of aphids with Orthene. When I examined the situation, what I found was tobacco leaves covered with cast skins, honeydew, and sooty mold. There were no live aphids. Orthene will kill the aphids, but it will not (nor will anything else) get rid of the cast skins and damage.

Tobacco that has been damaged by aphids will carry that damage all the way to the warehouse floor. Leaves will be thinner, black, and stuck together. The result is a mess. The tobacco is of very poor quality and, justifiably, brings a lower price. The way to avoid aphid damage to your tobacco is to control the aphids before they build up to such high numbers.

The red form of the green peach aphid is more difficult to control than the green form. Both Admire (and generic brands of imidacloprid) and Platinum used in the greenhouse will give excellent control of the red and green forms of the green peach aphid.

PRECAUTIONS USING INSECTICIDES

ALL insecticides should be applied according to label precautions and restrictions.

TOBACCO INSECT CONTROL IN THE PLANT BED

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER 1000 SQ FT	MIXING AND APPLICATION	REI
Aphids & Flea Beetles	Acephate (Orthene 97) *{1B}*	3/4 ** tbsp	Mix spray using 3/4 tbsp per 1 gal water/1000 sq ft.	24
Cutworms	Acephate (Orthene 97) *{1B}*	3/4 tbsp	Mix spray using 3/4 tbsp per 1 gal water/1000 sq ft.	24
Slugs or Snails	Metaldehyde 5B	2 lb	Scatter around margins, walkways, and open spaces in beds.	12

* Modes of action of insecticides are indicating using the classification defined by the Insecticide Resistance Action Committee (http://www.irac-online.org).
** tbsp = tablespoon

TOBACCO INSECT CONTROL IN GREENHOUSES

Acephate (Orthene 97) is labeled for use on tobacco in greenhouses to control cutworms, flea beetles, the green peach aphid, and the tobacco aphid, at a rate of ¾ lb/A. Apply to foliage at the equivalent of 3/4 tbsp in 3 gal water/1000 sq ft of bed. Apply evenly to ensure thorough coverage. Note: Floatbed water should be disposed of in the transplanted field through the transplant water or through foliar spray.

Imidacloprid - Admire Pro has replaced Admire 2F. Both products have the same active ingredient (imidacloprid). However, the Admire Pro formulation is more concentrated, therefore the rates will be different. It is labeled at 0.5 fl oz/1000 plants for aphids and flea beetles and 0.6-1.2 fl oz/1000 plants for mole crickets and wireworms. For tomato spotted wilt suppression, use 0.8-1.2 fl oz/1000 plants.

Admire 2F and generic brands are also labeled for use on tobacco as a drench to trays or flats prior to transplanting. Labeled rates are 1 fl oz/1000 plants for aphids and flea beetles and 1.4-2.8 fl oz/1000 plants for mole crickets and wireworms. Although this is a greenhouse application, imidacloprid will control these insects in the field for most of the growing season. For tomato spotted wilt suppression, use 1.8-2.8 fl oz/1000 plants.

Thiamethoxam (Platinum 2 SC) is labeled for use on tobacco as a drench to trays or flats prior to transplanting. It is labeled at 0.8-1.3 fl oz/1000 plants for aphids, flea beetles, and Japanese beetles, and 1.3 fl oz/1000 plants for wireworms. Although this is a greenhouse application, it is for control of these insects in the field. For tomato spotted wilt suppression, use 0.8-1.3 fl oz/1000 plants.

An insecticidal soap, **M-Pede**, is also labeled for use on tobacco in the greenhouse. However, its effectiveness has not yet been established.

"ALL insecticides should be applied according to label precautions and restrictions."

TOBACCO INSECT CONTROL IN THE FIELD

Note on tobacco hornworm and tobacco budworm control: in addition to foliar applications of insecticides (see products listed below), insecticides with chlorantraniliprole are now labeled for use in transplant water (Coragen [chlorantraniliprole]; Durivo [chlorantraniliprole and thiamethoxam]). It is important to follow recommendations for water usage to insure that roots receive sufficient moisture.

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
WIREWORMS	Ethoprop (Mocap 15 G **[R]**) *{1B}*	13 lb	Broadcast granules with spreader or apply sprays evenly over area at least 7-10 days before transplanting and disc to mix 2-4 inches into soil.	48
	Imidacloprid (Admire Pro) *{4A}*	0.6-1.2 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire Pro) *{4A}*	0.8-1.2 fl oz/ 1000 plants	Apply in transplant water in a minimum of 100 gal/A.	12
	Imidacloprid (Admire 2F and generic brands) *{4A}*	1.4-2.8 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire 2F and generic brands) *{4A}*	1.8-2.8 fl oz/ 1000 plants	Apply in-furrow or transplant water.	12

TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
WIREWORMS (CONT)	Thiamethoxam (Platinum 2 SC) *{4A}*	1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam and chlorantraniliprole (Durivo) *{4A} {28}*	1.6 fl oz/ 1000 plants	Apply at transplant.	-
APHIDS	Acephate (Orthene 97) *{1B}*	0.5 lb	Apply in 10-50 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	24
	Imidacloprid (Admire Pro) *{4A}*	0.5 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire Pro) *{4A}*	0.6 fl oz/ 1000 plants	Apply in transplant water in a minimum of 100 gal/A.	12
	Imidacloprid (Admire 2F and generic brands) *{4A}*	1.0 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire 2F and generic brands) *{4A}*	1.4 fl oz/ 1000 plants	Apply in-furrow or transplant water.	12
	Imidacloprid (Provado 1.6 F) *{4A}*	2-4 oz	Apply in 20-40 gal spray/A for complete coverage.PHI = 14 days	12
	Lambda-cyhalothrin/ chlorantraniliprole (Besiege) *{3A} {28}*	5-9 oz	Use at least 10 gal spray/ac. PHI = 40 days (suppression only)	12
	Methomyl (Lannate LV **[R]** or SP **[R]**) *{1A}*	1.5 pts or 0.5 lbs.	Apply in 20-40 gal spray/A for complete coverage. PHI = 5 days	48
	Pymetrozine (Fulfill 50 WG) *{9B}*	2.75 oz	Same as above. Do not make more than two applications per season.	12
	Thiamethoxam (Platinum 2 SC) *{4A}*	0.8-1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam (Actara) *{4A}*	2-3 oz	Use at least 20 gal spray/ac. PHI = 14 days.	12
	Thiamethoxam and chlorantraniliprole (Durivo) *{4A} {28}*	0.6-1.6 fl oz/ 1000 plants	Apply at transplant.	-
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) *{4A} {28}*	2.5-4 oz	Use at least 20 gal spray/ac. PHI=14 days	12

TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
FLEA BEETLES	Acephate (Orthene 97) *{1B}*	0.5 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Carbaryl (Sevin 80S or 4F) *{1A}*	1.25-2.5 lb 1-2 qt	Apply in 20-40 gal spray/A for complete coverage. PHI = 0	12
	Imidacloprid (Admire Pro) *{4A}*	0.5 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire Pro) *{4A}*	0.6 fl oz/ 1000 plants	Apply in transplant water in a minimum of 100 gal/A.	12
	Imidacloprid (Admire 2F and generic brands) *{4A}*	1.0 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire 2F and generic brands) *{4A}*	1.4 fl oz/ 1000 plants	Apply in-furrow or transplant water.	12
	Imidacloprid (Provado 1.6 F) *{4A}*	4 oz	Apply in 20-40 gal spray/A for complete coverage. PHI = 14 days	12
	Methomyl (Lannate LV **[R]** or SP **[R]**) *{1A}*	0.75-1.5 pts or 0.25-0.5 lbs	Apply in 20-40 gal spray/A for complete coverage. PHI = 5 days	48
	Thiamethoxam (Platinum 2 SC) *{4A}*	0.8-1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam (Actara) *{4A}*	2-3 oz	Use at least 20 gal spray/ac. PHI = 14 days.	12
	Thiamethoxam and chlorantraniliprole (Durivo) *{4A} {28}*	1.0-1.6 fl oz/ 1000 plants	Apply at transplant.	-
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) *{4A} {28}*	2.5-4 oz	Use at least 20 gal spray/ac. PHI=14 days	12

TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
BUDWORMS	Acephate (Orthene 97) *{1B}*	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Bacillus Thuringiensis** *{11}*	(see label)		
	Bacillus Thuringiensis *{11}*	5-10 lb	Commercially prepared bait. Place small pinch in bud of each plant with a gloved hand or mechanical applicator.	Bait
	Chlorantraniliprole (Coragen) *{28}*	3.5-7.5 oz 5.0-7.5 oz	foliar application (PHI = 1 day) transplant water application at planting	4
	Lambda-cyhalothrin (Karate Z) *{3A}*	0.96-1.92 oz	At least 2 gallons per acre. PHI = 40 days.	24
	Lambda-cyhalothrin/ chlorantraniliprole (Besiege) *{3A} {28}*	5-9 oz	Use at least 10 gal spray/ac. PHI = 40 days	12
	Methomyl (Lannate LV **[R]** or SP **[R]**) *{1A}*	1.5 pts or 0.5 lbs.	Use at least 10 gal spray/ac. PHI = 5 days	48
	Spinosad (Tracer or Blackhawk)*{5}*	1.4-2.9 oz or 1.6-3.2 oz	Use at least 20 gal spray/ac. PHI = 3 days.	4
	Thiamethoxam and chlorantraniliprole (Durivo) *{4A} {28}*	1.6 fl oz/ 1000 plants	Apply at transplant.	-
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) *{4A} {28}*	4 oz	Use at least 20 gal spray/ac. PHI=14 days	12

TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
HORNWORMS 	Acephate (Orthene 97) *{1B}*	0.5 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Bacillus Thuringiensis** *{11}*	(see label)		
	Carbaryl (Sevin 80S or 4F) *{1A}*	1.25-2.5 lb 1-2 qt	Apply in 20-40 gal spray/A for complete coverage. PHI = 0	12
	Chlorantraniliprole (Coragen) *{28}*	3.5-7.5 oz 5.0-7.5 oz	foliar application (PHI = 1 day) transplant water appl. at planting	4
	Lambda-cyhalothrin (Karate Z) *{3A}*	0.96-1.92 oz	At least 2 gallons per acre. PHI = 40 days.	24
	Lambda-cyhalothrin/ chlorantraniliprole (Besiege) *{3A} {28}*	5-9 oz	Use at least 10 gal spray/ac. PHI = 40 days	12
	Methomyl (Lannate LV **[R]** or SP **[R]**) *{1A}*	0.75-1.5 pts 0.25-0.5 lbs	Use at least 10 gal spray/ac. PHI = 5 days	48
	Spinosad (Tracer or Blackhawk)*{5}*	1.4-2.9 oz or 1.6-3.2 oz	Use at least 20 gal spray/ac. PHI = 3 days.	4
	Thiamethoxam and chlorantraniliprole (Durivo) *{4A} {28}*	1.6 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	-
HORNWORMS (*cont.*)	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) *{4A} {28}*	4 oz	Use at least 20 gal spray/ac. PHI=14 days	12
LOOPERS 	Acephate (Orthene 97) *{1B}*	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Bacillus thuringiensis** *{11}*	(see label)		
	Methomyl (Lannate LV **[R]** or SP **[R]**) *{1A}*	1.5 pts 0.5 lbs	Use at least 10 gal spray/ac. PHI = 5 days.	48

TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT *{MODE OF ACTION GROUP}**	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
GRASSHOPPERS	Acephate (Orthene 97) *{1B}*	0.25-0.5 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
STINK BUGS 	Acephate (Orthene 97) *{1B}*	0.5-0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Chlorantraniliprole (Coragen) *{28}*	3.5-7.5 oz	foliar application. PHI = 1 day	4
JAPANESE BEETLES 	Carbaryl (Sevin 80S or 4F) *{1A}*	1.25-2.5 lb 1-2 qt	Apply in 20-40 gal spray/A for complete coverage. PHI = 0	12
	Acephate (Orthene 97) *{1B}*	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Imidacloprid (Provado 1.6 F) *{4A}*	4 oz	Apply in 20-40 gal spray/A for complete coverage. PHI = 14 days	12
	Thiamethoxam (Actara) *{4A}*	2-3 oz	Use at least 20 gal spray/ac. PHI = 14 days.	12
	Thiamethoxam (Platinum 2 SC) *{4A}*	0.8-1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) *{4A} {28}* .	2.5-4 oz	Use at least 20 gal spray/ac. PHI=14 days	12
CUTWORMS 	Chlorpyrifos (Lorsban 15 G or 4 E **[R]**) *{1B}*	13.5 lb or 2 qt	Apply as preplant broadcast granules or a preplant broadcast spray in not less than 10 gal spray/A. Incorporate into soil 2-4 inches. **CAUTION:** Do NOT apply to foliage.	24
	Acephate (Orthene 97) *{1B}*	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
VEGETABLE WEEVILS 	Acephate (Orthene 97) *{1B}*	0.5 to 0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12

* Modes of action of insecticides are indicating using the classification defined by the Insecticide Resistance Action Committee (http://www.irac-online.org).

** *Bt products labeled for use on tobacco in South Carolina include Dipel, Biobit, Thuricide, MVP, Lepinox and Agree.*

ON-FARM CONTROL OF TOBACCO MOTH AND CIGARETTE BEETLE

INSECTICIDE	DOSAGE	HOW, WHERE, AND WHEN TO APPLY
Heat treatment Tobacco moth and Cigarette beetle (all stages)	140°F 	Hang in barn for a few hours. CAUTION: Tobacco must be thoroughly dried at temperature below 100°F before increasing temperature or color will change and result in decreased price.
Dichlorvos (Vapona) Resin strips *{1B}* Tobacco moth (moth only)	1 per 1,000 cu ft of space	Effective in reasonably tight storage facilities. Hang one resin strip per 1,000 cu ft of storage space. Replace if live moths are noticed.
Bacillus thuringiensis* *{11}* Tobacco moth (larvae only)	(see label) 	Apply as a fine mist. Spray leaves in layers as tobacco is being sheeted, re-sheeted, or placed in a pile for storage. Good coverage is essential. CAUTION: Avoid excessive moisture.

**The only Bt product labeled for this use in South Carolina is Dipel.*

TOBACCO DISEASE MANAGEMENT

Paul D. Peterson, Research Associate Professor

General Information

Endemic diseases such as bacterial wilt, black shank and root-knot nematodes always cause significant disease losses in South Carolina. Tomato spotted wilt, target spot, and blue mold also have the potential of causing disease problems in SC as well. These important and potentially devastating diseases of tobacco can best be managed through a combination of control methods. It is urged that growers identify disease problems in their fields and follow disease management suggestions based on rotation, variety selection, sanitation and chemical treatments. A sound disease management strategy cannot be developed without the proper identification of the disease problems in your fields. Disease development is a dynamic process and can change over time. A low disease loss in your fields in the recent past does not assure disease losses will remain low!

Disease Management Strategy

Disease losses affect tobacco yields, quality and profitability. Disease control options can be expensive to use and costly especially if the wrong control option is chosen. Great care needs to be exercised to assure a return on your control investment.

Rotation: The best defense against most diseases and the least expensive is a good, well-planned rotation. However, the diseases must be correctly identified within particular fields to develop a sound rotation plan. Any rotation is better than no rotation, but certain crops will do a better job of suppressing certain diseases. While some growers take a chance and do not rotate, sooner or later they will get caught with unexpected losses. Some diseases, such as bacterial wilt or black shank, may destroy entire fields! Also, some diseases such as mosaic and nematodes may be causing more damage than realized through observation because the plant may not completely die. Losses to these diseases are easily masked in a year in which rainfall was plentiful. Although difficult to see, these losses substantially reduce farm income! Losses to the three major diseases in South Carolina, that consistently reduce yields from year to year, can be reduced through a planned rotation program.

Host Resistance: Selection of resistant varieties provides a highly effective and inexpensive method of reducing losses to disease. Varieties differ in resistance to black shank, bacterial wilt, tobacco mosaic, Fusarium wilt and root-knot nematodes, so any one variety will not be the best choice in all fields. Study the disease ratings within the tobacco production guide to select appropriate varieties for your farm.

Chemical Treatments: Selection of chemical treatments should be your LAST CONSIDERATION in a disease control strategy. Rotation, variety selection and proper sanitation reduce populations of pathogenic organisms to levels that can be controlled by chemical applications. Choose your chemicals to match the disease pressure in your fields.

Bacterial Wilt Control

Bacterial wilt is the most serious of the soil-borne diseases of tobacco in South Carolina. It is very difficult to manage. The disease is concentrated in the eastern-most counties in the Pee Dee Region, but is present and increasing in severity in other important tobacco-producing counties.

Symptoms of bacterial wilt appear first as a wilt of leaves on one side of the plant. Eventually, the entire plant wilts, and infected plants usually die. Stalks appear dark brown or black at the ground level and look very much like black shank. However, bacterial wilt-infected plants have black streaks in the tissue just under the outer bark. Portions of lower stalk tissue will ooze milky strands of bacteria when placed in a clear container of water.

Bacterial wilt is a disease that is caused by a bacterium (*Ralstonia solanacearum*), which lives in the soil. These bacteria cause disease when they infect the roots through wounds. Any type of root wounding provides an entry point for infection. Therefore, shallow cultivation will help to avoid wounding roots, which provide points for infection. Natural wounds occur in the root system as a result of root growth through the soil; therefore, a certain amount of natural infection can take place, if the bacterial population is high enough in the soil around the root system.

The bacterium that causes bacterial wilt also infects a number of other crop plants, such as tomatoes, potatoes, peppers, eggplant and peanuts. Ragweed is a very common weed that is a host for the bacterium. Therefore, it is very important to recognize and control this weed thoroughly in areas planned for tobacco. The bacteria are very persistent in soil, and long rotations (three years or longer) may be necessary in some fields to assist in managing the disease. Rotation is imperative for management. Multipurpose chemicals (Telone C-17 and Chlor-O-Pic) also assist in control. Bacterial wilt MUST be managed by a combination of rotation, variety selection, and possible use of multipurpose chemicals. Other helpful practices include root and stalk destruction, enhanced soil drainage (utilize a high wide bed) and early shallow cultivation to avoid root wounding. It is also VERY IMPORTANT to avoid spread of bacterial wilt by movement of infested soil on farm equipment or by other means.

Mechanical Spread of Bacterial Wilt

Infection of tobacco in the field occurs typically through the root system. However, mechanical transmission of the bacterium during topping and harvesting also plays a significant role in the spread and severity of the disease.

BEST MANAGEMENT SYSTEM FOR CONTROL OF BACTERIAL WILT

The following points should be considered to help control bacterial wilt:

1. Crop rotation to include soybeans
2. Use of host resistance
3. Multipurpose soil fumigation
4. Hand topping or prioritize order of topping, and harvesting (**healthy tobacco first**). Consider using the redesigned topper blade which applies Clorox as a disinfectant.
5. Eliminate or reduce stalk wounding at harvest. Keep harvesters clean and properly adjusted to **avoid stem injury**
6. Use Roundup to kill stalks or immediate stalk destruction following last harvest
7. Maintain proper drainage in field
8. Use of a winter cover crop

MULTI-PURPOSE CHEMICALS FOR BACTERIAL WILT AND NEMATODE CONTROL.

MATERIAL	RATE/A	REMARKS	REI
Telone C17	10.5 gal	CAUTION: 3-week waiting period between Application and Transplanting.	5 days
Chlor-O-Pic	3.0 gal	Same as above.	48 hr and gas conc. less than 0.1 ppm
Remarks: Multi-purpose fumigants require waiting periods of up to 3 weeks before tobacco can be safely transplanted into fumigated soils. Good disease control by fumigation is possible whenever soil moisture and soil temperature conditions (55° F at 6 inches is best) are favorable. Cold, wet soils will not allow fumigants to work to the best of their capability. In-row multipurpose fumigation can be applied during the subsoiling operation. Placement of fumigant below the clay subsoil should be avoided. Soil moisture should not be excessive at the point of injection or poor control will be achieved.			

Black Shank Control

Black shank can cause significant losses in South Carolina tobacco. Black shank is caused by a fungus (*Phytophthora parasitica* var. *nicotianae*), which lives in the soil and attacks the plant primarily through the roots. Wounds are not required for infection by the black shank fungus. High soil moisture favors root colonization by the black shank fungus, although effects of early season infections become most apparent when soil moisture becomes limited. Sustaining high disease losses from black shank is tragic, because we know that rotation is very effective in reducing levels of the fungus in the soil. Any rotation is effective to some degree, because tobacco is the only host of the black shank fungus. The longer the rotation, the more effective the control. Therefore, rotation is the backbone of a successful control strategy, which also should utilize resistant varieties, chemicals and cultural practices.

FIELD INFESTATION LEVEL	ROTATION	VARIETAL RESISTANCE OPTIONS	CHEMICAL CONTROL
High (More than 6% disease)	1) 4 years	Moderate to high	Nematicide
	2) 3 years	High only	Multipurpose or Fungicide + Nematicide
	3) 2 years	High only	Fungicide + Nematicide
Moderate (1% - 6% disease)	1) 3 years	Low to High	Nematicide
	2) 2 years	High only	Multipurpose or Fungicide + Nematicide
	3) None*	High only	Fungicide + Nematicide
Low (Less than 1% disease)	1) 2 years	Low to high	Nematicide
	2) None*	High only	Multipurpose or Fungicide + Nematicide

Remarks: Continuous culture (tobacco following tobacco) is not recommended. However, if this cropping system is chosen, use only varieties with high resistance and a black shank control chemical. Do NOT consider continuous culture if the infestation level is greater than 6% of the plants having black shank.

Continuous use of new varieties with high resistance and the ph gene without crop rotation may lead to the development of new strains of the pathogen reducing the effectiveness of the newer resistant cultivars. Numerous fields have been observed with race 1 of black shank, which can causes disease on varieties with the ph gene. Producers should consider rotating tobacco varieties to include lines with and without the ph gene (see tobacco variety table in South Carolina Tobacco growers Guide). If race 1 occurs within your field (disease observed in a variety with the ph gene which imparts immunity to race 0) consider using a variety with high resistance that does not contain the ph gene. In addition, continuous use of new varieties with high resistance to black shank without crop rotation may lead to losses from other diseases such as fusarium wilt (see disease resistance ratings in SC Tobacco Growers Guide).

Ridomil Gold and two new fungicides, Orondis Gold 200 and Presidio, are labelled for use on tobacco in 2017. Please see tables and information below for application recommendations, **BUT ALWAYS CONSULT THE INDIVIDUAL PRODUCT LABEL FOR COMPLETE USE DIRECTIONS AND APPLICATION INFORMATION**.

RIDOMIL GOLD FOR BLACK SHANK CONTROL

ROTATION	RIDOMIL GOLD SL APPLICATION	REI
None (Continuous tobacco is **NOT recommended**)	1 qt/A preplant broadcast OR 1 pt/A preplant broadcast + 1 pt /A layby* OR 1 pt/A preplant +1 pt/A first cultivation + 1 pt/A layby*	48 hr
2 year (Tobacco in alternate years)	1.5 pt /A preplant broadcast OR 1 pt/A preplant broadcast + 0.5 pt /A layby*	48 hr
3 year or more (Tobacco every third year or more)	1 pt /A preplant OR 1 pt/A preplant broadcast + 0.5 pt/A layby*	48 hr
Remarks: *Apply Ridomil at layby cultivation using two drop nozzles per row directed to the sides of the bed. REI = reentry interval		

RIDOMIL GOLD FOR PRE-PLANT & POST-PLANT CONTROL OF BLACK SHANK

Application site	RIDOMIL GOLD SL APPLICATION	REI
Transplant water 24-C label or post-plant soil applications	Apply in transplant furrow while planting tobacco seedlings. Apply in 4-8 oz/A (0.25-0.5 pt/A) in at least 200 gallons of transplant water per acre. **Additional soil applications (1st cultivation and/or layby) may be needed if disease pressure is high. Do Not Exceed label rate for the season**. **Consult label for potential of crop injury and application directions! 24-C Label should be in your possession at the time of application.**	48 hr.

PRESIDIO FOR POST-PLANT CONTROL OF BLACK SHANK

Application Rates		Minimum Time from Last Application to Harvest (PHI)	Specific Use Instructions
fl oz/A	**GPA Spray Mixture**		
4 (0.125 lb ai/A)	Ground: Minimum 20	N/A	**Post-transplant program**: one application of *Presidio* fungicide can be made at either first cultivation or layby (last cultivation). Direct nozzles to cover soil beneath lower leaves incorporate immediately with cultivator.

*For best control of black shank with *Presidio* Fungicide, use with tobacco varieties that have moderate-to-high resistance to the black shank pathogen. Consult your local Cooperative Extension Service office or university specialist for information on variety selection.

ORONDIS GOLD 200 FOR PRE-PLANT & POST PLANT CONTROL OF BLACK SHANK

Rate (fl oz/A)	Application Timing
4.8 - 19.2	Apply at planting in furrow or in transplant water.
	Apply soil-directed or banded applications at 1st cultivation and layby.

Resistance Management:
- Make no more than 2 sequential applications before rotating to a fungicide with a different mode of action.
- Do not follow soil applications of Orondis Gold 200 with foliar applications of Orondis Opti A or Orondis Ultra A.

USE RESTRICTIONS

1. 1) **Maximum Single Application Rate:** Do not exceed 19.2 fl oz per acre per application.
2. 2) **Maximum Annual Rate:** Do not exceed 38.6 fl oz per acre per year.
3. 3) **Maximum Number of Applications:** Do not make more than four applications per crop.
4. 4) **Minimum Application Interval:** 7 days
5. 6) **Pre-harvest Interval (PHI):** 7 days

ORONDIS + RIDOMIL GOLD CO-PACK FOR PRE-PLANT & POST PLANT CONTROL OF BLACK SHANK

Rate Orondis Gold 200 + Ridomil Gold SL	Use rate per 2 (ee) Recommendation
Maximum amount per season Orondis Gold 200 + Ridomil Gold SL	Do not exceed 38.6 fl. Oz. of Orondis Gold 200 soil use per acre per season Do not exceed the equivalent of 1.5 lbs. a.i. per acre of mefenoxam-containing products
Minimum gallons per acre (GPA)	Transplant (setter) water drench: 200 GPA 1st Cultivation: 20 GPA Layby: 40 GPA
Preharvest Interval (PHI)	7 days
Adjuvants	Do not combine with adjuvants, surfactants or fertilizers, unless prior use has shown the combination physically compatible, effective and non-injurious under your conditions of use
Crop Rotation Intervals	0 days to crops on label 30 days to cereals and grass animal feeds 180 days to all other crops

Recommended Black Shank Fungicide Programs for 2017

The opportunity to use the Orondis Gold 200 + Ridomil Gold SL co-pack in a transplant-water application in 2017 offers new options for improved black shank control. Orondis Gold 200 needs to reach plant roots early to be effective, but when it does, it has shown excellent results in longer-term control. Its low water solubility also makes it less mobile in the soil, which is facilitated by application in the transplant water. The addition of Ridomil Gold in the co-pack also provides improved Pythium control. The following two program recommendations, **A & B**, take into consideration field sites with moderate or high history of disease. Because Ridomil Gold is water soluble, it may leach out of the root zone if a heavy rainfall event occurs after transplanting. In this case, consider an additional Ridomil application to maintain both black shank and Pythium control. Do not exceed label rate for the season, however.

Fungicide Program – Plan A
Two Applications – Moderate Disease Pressure

1. In Transplant Water
   - Orondis/Ridomil Co-Pack

2. At Layby
   - Ridomil Gold

     Or
   - Presidio

Fungicide Program – Plan B
Three Applications – High Disease Pressure

1. In Transplant Water
   - Orondis/Ridomil Co-Pack

2. At 1st Cultivation
   - Presidio

3. At Layby
   - Ridomil

Always Consult the Individual Product Label for Complete Use and Application Information

Tomato Spotted Wilt Control

TSW infections occur through wounds in epidermal cells caused by tobacco thrips. Generally insecticides have been ineffective in reducing virus transmission because very little time is required to transmit the virus. The insecticide may kill the insect but only after the plant has already acquired the virus. Thrips population's peak in April and May and then decline in June. This approximates the timing of TSW seen in South Carolina.

The following points should be considered to help control Tomato Spotted Wilt:

1. Avoid early planting
2. Apply Admire (Imidacloprid) as a tray drench (refer to product label for application instructions)
3. Use healthy disease free seedlings to reduce stand loss to other pathogens
4. Follow fertility recommendations - avoid excessive nitrogen application
5. Irrigate if possible to assure sustained crop growth
6. Consider use of Actigard if expectation of disease loss is high or if severe losses to TSW were experienced in previous years (refer to product label for application instructions)

Target Spot Control

Target spot is endemic to South Carolina tobacco fields and is caused by a fungus (*Thanatephorus cucumeris*). Disease development is more severe during wet weather. The symptoms appear similar to brown spot and are easy to confuse. Necrotic tissue can become brittle, fall out, and leave a shot hole appearance. Under high relative humidity lesions can increase rapidly blighting large portions of the leaf.

FOLIAR TREATMENTS*	RATE	REMARKS
Quadris Flowable	6.0-12.0 oz/A	Apply on a 7-14-day interval with shorter intervals under conditions conducive to disease development. For ground application apply Quadris in sufficient water volume for adequate coverage and canopy penetration. Do not tank mix with Thiodan Quadris should be applied as a component in an **Integrated Pest Management strategy**. Check label for application information and potential crop injury. REI = 4 hours
Remarks: REI = reentry interval.		

Blue Mold Control

Blue mold occurs in Florida and Georgia almost every year and has the potential to cause severe losses in South Carolina. Ridomil resistant strains have been observed in other states and pose a possible threat to the tobacco crop in South Carolina. Blue mold is potentially one of the most destructive diseases of tobacco. It is caused by a fungus (*Peronospora tabacina*) that is airborne, and disease can spread very quickly, leading to epidemics if not properly managed. Acrobat has received a label for blue mold control but should be used in combination with another fungicide. Presidio received a label for blue mold control in 2015.

FIELD BLUE MOLD CONTROL

SOIL TREATMENTS	RATE	REMARKS
Ridomil Gold	0.5-1 pt/A	Broadcast and incorporate 2-4 inches at or before transplanting. An additional 0.5 pt/A may be used at layby if no more than 1 pt/A was applied at planting. REI = 48 hr.
FOLIAR TREATMENTS*	**RATE**	**REMARKS**
Forum (formerly Acrobat)	2-8 fl oz	Forum must be tank mixed with a product registered for control of blue mold, such as mancozeb, for resistance management. Neither Ridomil Gold nor Actigard are recommended as a tank-mix with Forum. Consult label before tank mixing with any product. Do not exceed 30 oz/season. REI = 0 days. Tobacco may be harvested the day of the last application, after the spray has dried.
Actigard 50 WG	0.5 oz/A	Begin application after plants reach a height of 12 inches. Apply on a preventative schedule when blue mold threatens. Another registered blue mold product should be used prior to 12 inches for early season control and after the final application if conditions are conducive for disease. Make up to 3 applications on a 10-day schedule. Apply in a minimum of 20 gals. /A. Application of Actigard may result in leaf yellowing. This cosmetic yellowing normally disappears after final application. REI = 12 hr.

FOLIAR TREATMENTS*	RATE	REMARKS
Quadris Flowable	6.0-12.0 oz/A	Quadris application should begin prior to disease development or at first indication that blue mold is in the area. Do Not apply Quadris as a curative application. If blue mold is present in the field, initiate application with Acrobat MZ prior to Quadris application. Apply on a 7-14-day interval with shorter intervals under conditions conducive to disease development. For ground application apply Quadris in sufficient water volume for adequate coverage and canopy penetration. Do not tank mix with Thiodan. Check label for potential crop injury. REI = 4 hours
Presidio	4 (0.125) lb ai/A	For resistance management, Presidio Fungicide must be tank mixed with a labeled rate of another fungicide active against the target pathogen, but with a different mode of action. Apply as a foliar spray prior to disease onset or at first indication that blue mold is in the area. A second foliar application may be made, with a minimum treatment interval of 7 days between foliar applications. Make no more than 2 foliar applications per season. REI = 12 hours
Orondis Ultra A	2.0 – 4.8 oz/A	Begin applications prior to disease development, and continue on a 7- to 10-day interval. Use the higher rates when disease is present, for longer application intervals, or for susceptible varieties. For conventional ground application, apply at least 15 gallons per acre, increasing the spray volume as the plants mature to ensure thorough coverage of the foliage. For air-assisted ground application, apply at least 10 gallons per acre. For aerial application, apply at least 2 gallons per acre. **Maximum Single Application Rate:** Do not exceed 4.8 fl oz per acre per application. **Maximum Annual Rate:** Do not exceed 19.2 fl oz per acre per year. **Maximum Number of Applications:** Do not exceed six foliar applications per acre per year for the same crop. Do not use for more than 33% of the total foliar fungicide applications. **Minimum Application Interval:** 7 days **Pre-harvest Interval (PHI):** 7 days **Resistance Management:** Make no more that 2 sequential applications before rotating to a fungicide with a different mode of action. Do not follow soil applications of Orondis with foliar applications of Orondis Ultra A. Use either soil applications or foliar applications but not both for disease control.

REI = reentry interval

TOBACCO GREENHOUSE DISEASE CONTROL

There are several potentially important disease problems that may occur in greenhouse transplant production systems. These include target spot (*Rhizoctonia solani*), white mold or stem rot (*Sclerotinia spp.*), damping-off caused by *Pythium* spp. or *Rhizoctonia* spp., blue mold (*Peronospora tabacina*), gray mold (*Botrytis cinerea*), soft rot (*Erwinia* spp.) and tobacco mosaic virus. The potential also exists for diseases most often associated with field-grown tobacco to occur, and include bacterial wilt (*Ralstonia solanacearum*) and black shank (*Phytophthora parasitica* var. *nicotianae*).

It is imperative that producers take extra precautions to prevent pathogens from entering the greenhouse and to minimize environmental conditions within the greenhouse that might encourage disease development. Thus, ventilation, sanitation, monitoring, and use of good production practices are important disease management factors.

DISEASE	CHEMICAL	RATE/50 GAL WATER	REMARKS*
Target Spot Blue Mold	Quadris Flowable 24-C Label	6 oz/A or 0.14 oz (4 ml)/1000 ft^2 in enough water for thorough coverage (recommended 5 gal/1000 ft^2)	Make only one application prior to transplanting. Follow up applications can be made in the field according to the Quadris federal label. **Greenhouse 24-C Label should be in your possession at the time of application.** REI = 4 hours
	Terramaster 4EC	1.4 oz/100 gal water	Do not apply as a drench or in irrigation water. Apply this product only to tobacco float-bed water. Consult the label for mixing directions. Crop injury can occur with improper mixing. Terramaster 4EC used as a **preventative treatment** before symptoms occur, mix 1.4 fl. oz of Terramaster /100 gal of water no sooner than three weeks after seeding. A sequential preventative application of 1.4 fl oz/100 gal of water can be made 3 weeks after the first application. Do not apply Terramaster 4EC later than 8 weeks after seeding. REI = 12 hr.
	Terramaster 4EC	1.4 oz/100 gal water	Terramaster 4EC used as a **curative treatment** when symptoms first appear, mix 1.4 fl oz of Terramaster /100 gal of water no sooner than three weeks after seeding and when leaves are at least 1 in. in diameter. If Pythium symptoms recur after the first application, a second application of 1-1.4 fl oz/100 gal of water can be made. Allow at least a 3-week interval between the first and second application. Do not apply Terramaster 4EC later than 8 weeks after seeding. No more than 2.8 fl. oz. of Terramaster 4EC /100 gal of water may be applied to each crop of transplants. REI = 12 hr.
Remarks: The potential for phytotoxicity exists when Dithane DF or Manzate Pro-stick fungicide is used on tobacco seedlings. To minimize potential for damage, 72 hours prior to large scale application, user should test for potential phytotoxicity by applying the fungicide to a small sample area growing under similar conditions. In general, injury is greater in greenhouse systems. Ridomil Gold, or Acrobat are not labeled for use in greenhouses, or floatbed plant production systems. REI = reentry interval.			

TOBACCO NEMATODE CONTROL

Paul D. Peterson, Research Associate Professor

Damage caused by nematodes are difficult to estimate because damage to roots may not be apparent in above ground symptoms, yet significant reductions in yields can occur with moderate levels of nematodes. Nematodes may increase the incidence of other diseases such as black shank, bacterial wilt and Fusarium wilt. The reduced use of fumigants during wet springs always results in dramatic increases in nematode damage and demonstrates the importance of soil fumigation!

Good disease control by fumigation is possible whenever soil moisture and soil temperature conditions (55° F at 6 inches is best) are favorable. Cold, wet soils will not allow fumigants to work to the best of their capability. In-row fumigant nematicides should be applied during the subsoiling operation. **Placement of fumigant nematicides below the clay subsoil should be avoided.** Soil moisture should not be excessive **at the point of injection** or poor control will be achieved.

TOBACCO NEMATICIDES

NEMATICIDE	RATE/A	ROOT KNOT CONTROL		REMARKS*
		Southern (M. incognita)	Peanut (M. arenaria)	
FUMIGANTS:				
Telone II	6 gal	Excellent	Excellent	FR REI = 5 days
Telone II	8 gal	Excellent	Excellent	FB REI = 5 days
MULTIPURPOSE CHEMICALS: **				
Telone C17	10.5 gal	Excellent	Excellent	FR REI = 5 days
Telone C17	12 gal	Excellent	Excellent	FB REI = 5 days
Chlor-O-Pic	3 gal	Excellent	Very Good[1] Very Good[1]	FR REI = 48 hr and gas conc. less than 0.1 ppm
NONFUMIGANTS:				
Mocap 15 G	40 lb	Good	***	B & I REI = 48 hr

Remarks: * FR - Fumigant row; FB – Fumigant broadcast – place application chisels on 12 in centers; B & I - Broadcast and incorporate. ** Multipurpose chemicals have effectiveness for nematodes, and bacterial wilt.
*** Not registered for this nematode species.
[1] Although some root galling may occur at the end of the growing season, yield responses are similar among the multipurpose fumigants. **REI = reentry interval.**

AQUATIC WEED CONTROL

Cory Heaton, State Wildlife Specialist

Aquatic weeds in ponds or lakes can be controlled by physical removal, biological control, or herbicides. The method or combination of methods used will depend on factors such as target weeds, non-target plants, and what the water is used for. Physical removal can be accomplished manually or with machinery. It is time consuming, expensive and normally used alone if other methods are not feasible. However, a certain amount of physical removal may be necessary in combination with the use of biological control and herbicides. Prior to initiating any control measures it is crucial to accurately identify species to be controlled. Herbicides and biological control agents are not equally effective on all species. Numerous websites and mobile apps can aid in species identification. You can also submit aquatic plant species to Clemson University's Plant Problem Clinic through your local extension office for identification.

Biological control is an option for certain aquatic weeds. The major advantages are ease of application and no concern over damage to plants irrigated with treated water. Triploid grass carp can control many submerged vascular aquatic weeds. Grass carp are usually used to control all vegetation in a pond, rather than selectively controlling certain vegetation. Replacement stocking of grass carp is necessary when fish are lost. A permit is required to stock grass carp, and only triploid fish can be legally used in SC. Tilapia are stocked in the spring and control most algae species. The concern with tilapia is that they are tropical animals and usually die during cold winters thereby requiring an annual stocking. Tilapia are legal for use in SC. The South Carolina Department of Natural Resources (SC DNR) now requires a free of charge permit prior to stocking tilapia and triploid grass carp for aquatic weed control in SC. A permit can be obtained from SC DNR at 803-734-3891 or from registered dealers in SC. The short permit can be faxed (803-734-4748) for a rapid turn-around. Check with your Department of Natural Resources to determine if grass carp and tilapia are legal to stock and if a permit is required in your state.

Diquat, endothall, glyphosate, flumioxazin, fluridone, triclopyr, copper, sodium carbonate peroxyhydrate, 2,4-D, carfentrazone, bispyribac, imazapyr, penoxsulam, tompramezone, and imazamox compounds can be used safely in ponds used as irrigation sources if the manufacturer's label directions are followed. Certain waiting periods may be required before using water for irrigation after the herbicide is applied, while in some cases waiting periods are not required. Various chemicals have different product formulations; only aquatic labeled pesticides and surfactants/adjuvants may be used in aquatic applications, by law.

Effective October 2011, aquatic pesticide applications in SC require a permit from South Carolina Department of Health and Environmental Control (SCDHEC). These permits are issued in accordance with the federal Clean Water Act and the National Pollution Discharge Elimination System (NPDES). Aquatic pesticide applicators may be required to submit a Notice of Intent (NOI), practice Integrated Pest Management (IPM), and develop a Pesticide Discharge Management Plan (PDMP) in addition to the basic permit requirements. The additional requirements are based on established application thresholds. The threshold for aquatic weed control applications is 200 acres' treatment area or 20 miles of treated shoreline. Applicators below these levels are automatically covered by the SC general permit. Applicators above these levels will be required to submit a NOI, practice IPM, and possibly develop PDMP.

For more information on the NPDES permit please contact SCDHEC at (803) 898-4157 or online at http://www.scdhec.gov/environment/water/npdes_pesticide.htm.

Products for Use "To Waters Edge"

Aquatic applications in South Carolina do not always require products with full aquatic labels. In many instances, shoreline applications are made that do not involve product application directly into waters. Applications near but not into an aquatic environment can be made using products labeled for use "to waters edge". Products to be utilized for such applications must be labeled accordingly. While many of the products labeled for this use have terrestrial labels, not all terrestrial labeled products are labeled for use along the water's edge. It is the applicators responsibility select and only use products labeled specifically for this purpose.

Milestone Specialty Herbicide from Dow AgroSciences is an example of a product labeled for use to waters edge. The Milestone label states "It is permissible to treat non-irrigation ditch banks, seasonally dry wetlands and transitional areas between upland and lowland sites only when dry. Milestone can be used to the waters edge. Do not apply directly to water and take precautions to minimize overspray to open water when targeting vegetation in and around non-flowing, quiescent or transient water….". Label wording is not identical for every product. Always read the most current product label and only use products in accordance with the label.

Amount of Formulation for Application

Herbicide	**Rate***
Aquathol	0.3 to 2.6 gal/acre foot of 4.2 L or 13 to 108 lb of 10G/acre foot or 2.2 to 22.0 lb of 63G/acre foot.
Hydrothol	0.3 to 3.4 gal/acre foot of 2L or 11 to 136 lb of 11G/acre foot.
Diquat	1 to 2 gal/surface acre of 2L.
2,4-D	1 to 2 gal/surface acre of 3.8 L or 150 to 200 lb of 20G/surface acre.
Copper Compounds	0.6 to 3.4 gal of Chelated Copper/acre foot or 0.1 to 0.5 ppm elemental copper.
Fluridone	0.25 to 0.5 gal/surface acre. Check with company rep for exact rates.
Glyphosate	0.75 to 1.5% solution, depending on the weed species, using hand held application equipment
Triclopyr	2 to 8 quarts per surface acre of 3L.
Tompramezone	4.0-16.0 fl. oz. per acre for surface applications. 30-50 ppb for water treatment
Sodium Carbonate Peroxyhydrate	3 to 170 pounds per acre-foot of 50G.
Imazapyr	2 to 6 pints per acre.
Carfentrazone	3.4 to 13.5 fl. oz. per surface acre for floating vegetation - 0.286 gal/acre foot for submerged vegetation.
Penoxsulam	10 to 150 ppb; Not to exceed 150 ppb per growing season. Follow label for specific rates.
Imazamox	32 to 64 fl. oz. per surface acre broadcast foliar application. 50 to 500 ppb in water treatment
Flumioxazin	6-12 oz. per surface acre for surface applications. 100-400 ppb in water treatment or subsurface applications
Bispyribac	1-2 oz. per acre for surface applications. 20-45 ppb for water treatment or subsurface applications

***Acre foot** = 1 surface acre of water (43,560 ft^2) 1 foot deep.

Effectiveness of Herbicides for Aquatic Weed Control

Weed	Copper complexes (Copper sulfate)	2,4-D	Diquat (Reward)	Endothol Aquathol K & G	Endothol Hydrothol G & 191	Fluridone	Glyphosate	Sodium Carbonate Peroxyhydrate	Trichlopyr	Imazapyr	Carfentrazone	Penoxsulam	Imazamox	Flumioxazin	Bispyribac	Tompramezone
Algae																
Filamentous	E	P	P	-	G	P	P	E	-	-	-	-	-	E	-	-
Planktonic	E	P	G	-	G	P	P	E	-	-	-	-	-	P	-	-
Branched (Chara)	E	P	G	-	G	P	P	P	-	-	-	-	-	F	P	-
Nitella	E	P	G	-	G	P	P	P	-	-	-	-	-	F	P	-
Floating plants										-						
Bladderwort	P	P	E	-	-	E	-	P	-	-	-	-	G	-	-	F
Duckweeds	P	G[1]	G	P	P	E	P	P	-	E	E	E	-	E	-	-
Water hyacinth	P	E	E	-	-	P	G	P	E	E	E	E	E	P	E	G
Watermeal	P	P	P	-	-	G	P	P	-	-	G	G	-	E	F	-
Submersed plants																
Broadleaf watermilfoil	P	-	E	E	E	E	P	P	E	-	G	E	-	G	G	F
Coontail	P	G	E	E	E	E	P	P	-	-	-	-	-	G	P	-
Egeria	P	P	G	F	F	E	P	P	-	-	-	E	-	-	-	-
Elodea	P	-	E	F	F	E	P	P	-	-	-	E	-	E	-	-
Eurasian millfoil	P	E	E	E	E	E	P	P	E	-	E	E	F	G	G	-
Fanwort	P	F	G	E	E	E	P	P	-	-	-	-	-	G	-	-
Hydrilla	F[2]	P	G	G	G	E	P	P	-	-	-	E	F	G	E	G
Naiads	P	F	E	E	E	E	P	P	-	-	-	G	-	E	-	F
Parrotfeather	P	E	E	E	E	-	F	P	F	E	E	G	G	G	-	-
Pondweeds (Potamogeton)	P	P	G	E	E	E	P	P	-	-	-	E	G	G	G	G

E=excellent control (90 to 100%); G=good control (80 to 89%); F=fair control (70 to 79%); P=poor control (<70%). A blank space (-) indicates weed response is not known.

[1]Ester formulations only.

[2]Copper complex only

Effectiveness of Herbicides for Aquatic Weed Control – Continued

Weed	Copper complexes (Copper sulfate)	2,4-D	Diquat (Reward)	Endothol Aquathol K & G	Endothol Hydrothol G & 191	Fluridone	Glyphosate	Sodium, Carbonate Peroxyhydrate	Trichlopyr	Imazapyr	Carfentrazone	Penoxsulam	Imazamox	Flumioxazin	Bispyribac	Tompramezone
Emergent plants																
Alders	P	E	F	P	P	P	E	P	-	-	-	-	-	-	-	-
Alligatorweed	P	F	P	P	P	G	E	P	E	E	G	G	G	G	E	-
American lotus	P	E	P	P	P	F	G	P	E	E	-	-	F	-	-	F
Arrowhead	P	E	G	G	G	-	E	P	-	E	-	G	-	G	E	G
Buttonbush	P	E	F	P	P	P	G	P	-	E	-	-	-	G	-	-
Cattails	P	G	G	P	P	F	E	P	-	E	-	-	E	P	-	-
Common reed	P	P	P	P	P	P	G	P	-	E	-	-	F-G	P	-	-
Fragrant & white waterlily	P	E	P	P	P	E	E	P	E	E		-	G	F	F	-
Frogbit	P	E	E	-	-	-	-	P	E	E	-	-	E	G	E	-
Grasses, most	P	P	P	P	P	P	G	P	-	E	-	-	F	-	-	-
Maidencane	P	P	F	-	-	F	E	P	-	E	-	-	-	-	-	-
Pickerelweed	P	G	G	-	-	P	F	P	E	E	-	G	E	-	F	-
Pond-edge annuals	P	-	G	-	-	E	E	P	-	E	-	-	-	-	-	-
Rush	P	P	F	P	P	F	E	P	-	E	-	-	-	-	-	-
Sedges and rushes	P	F	F	P	P	P	G	P	-	E	-	-	-	P	F	-
Slender spikerush	P	-	G	-	-	G	P	P	-	-	-	G	F	-	-	-
Smartweed	P	E	F	-	-	F	E	P	E	E	-	G	G	P	G	F
Spatterdock	P	E	P	P	P	E	G-E	P	E	E	-	-	G	-	-	-
Southern watergrass	P	P	-	-	-	G	E	P	-	-	-	-	-	-	-	-
Torpedograss	P	P	P	-	-	F	G	P	-	E	-	-	-	-	-	F
Watershield	P	E	P	-	-	G	G	P	-	-	-	-	G	G	-	-
Water pennywort	P	G	G	P	P	P	G	P	E	E	-	E	E	G	G	-
Water primrose	P	E	F	-	-	F	E	P	E	E	G	-	F	G	-	-
Willows	P	E	F	P	P	P	E	P	-	E	-	-	-	-	P	-

E=excellent control (90 to 100%); G=good control (80 to 89%); F=fair control (70 to 79%); P=poor control (<70%). A blank space (-) indicates weed response is not known.

[1]Ester formulations only.

[2]Copper complex only

Waiting Period (Days) Before Using Water After Application of Herbicides for Aquatic Weed Control

Common Name	Trade Name	Irrigation	Fish Consumption	Watering Livestock	Swimming
Copper	Crystalline copper sulfate and various liquid organic copper complexes	NR[1]	NR	NR	NR
2,4-D	Various formulations and manufacturers[2]	Water use restrictions vary by formulation and manufacturer. Certain labels allow irrigation if an approved chemical assay has reached acceptable levels. A few labels allow irrigation with specific waiting periods. Certain labels **may** allow irrigation on established turf, immediately. CHECK INDIVIDUAL LABEL.			
Diquat	Reward	1 to 3[3]	NR	1	NR
	Weedtrine D	5	NR	5	NR
Endothall	Aquathol K	7 to 25	NR	7 to 25	NR
	Aquathol granular	7 to 25	NR	7 to 25	NR
	Aquathol Super K	7 to 25	NR	7 to 25	NR
	Hydrothol 191	7 to 25	NR	7 to 25	NR
	Hydrothol 191 granular	7 to 25	NR	7 to 25	NR
Fluridone	Avast, Sonar AS, Sonar SRP, Sonar PR, Sonar Q	7-30+	NR	NR	NR
Glyphosate	Rodeo, AquaNeat, AquaMaster, AquaPro	NR	NR	NR	NR
Sodium Carbonate Peroxyhydrate	Green Clean, Pak 27, Phycomycin	NR	NR	NR	NR
Triclopyr	Renovate	120[4]		NR[5]	NR
Imazapyr	Habitat	120	NR	NR	NR
Carfentrazone	Stingray	0-14[6]	NR	0 to 1	NR
Penoxsulam	Galleon	<30 ppb Turf <1 ppb Others	NR	NR	NR
Imazamox	Clearcast	See note 7	NR	NR	NR
Flumioxazin	Clipper	5 days	NR	NR	NR
Bispyribac	Tradewind	< 1 ppb	NR	< 1 ppb	NR
Tompramezone	Oasis	< 1 ppb	0	0	0

[1]NR = No restrictions.

[2]Most formulations do not permit application to ponds used for irrigation or for watering dairy cattle.

[3]Three days for irrigation of turf and nonfood crops; five days for irrigation of food crops (including tobacco) or for preparation of agricultural sprays.

[4]No restriction for established grasses and assay to reduce restriction time.

[5]14-day restriction on grazing site and growing. Season grazing restriction on lactating livestock after irrigating pasture.

[6]1 day if <20% of surface acreage is treated. 14 days if >than 20% is treated. Certified lab test of <5 ppb.

[7] DO NOT use treated water for greenhouses, nurseries or hydroponics – bioassay for canola, onions, potatoes or sugar beets; other crops 1 day

Common Aquatic Plants Consumed by Grass Carp[1]

Plants in order of common name preference

hydrilla 1	hygrophila 9	maidencane[2] (*Panicum*) 16
chara (muskgrass) 2	cattail[2] 10	parrot feather 16
pondweeds (*Potamogetan*) 3	torpedograss 10	know grass (*Paspalum*) 17
bushy pondweed (Southern naiad) 4	salvinia 10	water hyacinth 17
elodea 5	water-aloe (*Stratiotes*) 11	giant bulrush[2] 18
watermeal 6	watercress 12	water lettuce 18
duckweeds 7	torpedograss 13	soft-stem bulrush[2] 19
water-fern (*Azolla*) 7	Eurasian watermilfoil 14	
coontail 8	eel grass (*Vallisneria*) 15	

[1] Adapted from "Grass Carp - A Fish for Biological Management of Hydrilla and Other Aquatic Weeds in Florida" by David L. Sutton and Vernon V. Vandiver, Jr., University of Florida IFAS, Bulletin 867; and from "Managing Aquatic Vegetation With Grass Carp - A Guide For Water Resource Managers" edited by John R. Cassani, American Fisheries Society, Bethesda, Maryland.

[2]Young, succulent, underwater shoots are preferred. Some plants have the same number, which means grass carp like them equally

Aquatic Plant Management Internet References

AQUAPLANT – A Pond Manager Diagnostic Tool – Texas AgriLife Extension Service, Texas A&M University
http://aquaplant.tamu.edu/

Aquatic Plant Control Research Program – U.S. Army Corps of Engineers http://el.erdc.usace.army.mil/aqua/

Aquatic Plant Information System
http://el.erdc.usace.army.mil/aqua/apis/apishelp.htm

Center for Aquatic and Invasive Plants – University of Florida, IFAS
http://plants.ifas.ufl.edu/

South Carolina Department of Health and Environmental Control – NPDES Permitting
http://www.scdhec.gov/environment/water/npdes_pesticide.htm

South Carolina Department of Natural Resources – Commercial Aquatic Pesticide Applicators
www.dnr.sc.gov/wildlife/publications/pdf/LakeMgtConsultants.pdf

Aquatic Plant Management Mobile Apps

AQUAPLANT – A Pond Manager Diagnostic Tool – Texas AgriLife Extension Service, Texas A&M University
http://aquaplant.tamu.edu/useful-apps/

AQUACIDE – Aquatic Herbicide Selection, Effectiveness, and Restriction Guide – Texas AgriLife Extension Service, Texas A&M University
http://aquaplant.tamu.edu/useful-apps/

PONDCALC – Pond Size and Volume Calculator – Texas AgriLife Extension Service, Texas A&M University
http://aquaplant.tamu.edu/useful-apps/

Aquatic Plants – Aquatic Plant Identification Tool –NC State University
http://www.weedscience.ncsu.edu/aquaticweeds

FARM-STORED GRAIN INSECT MANAGEMENT

Robert G. Bellinger, Extension Entomologist

The quality of farm-stored grain is at its peak when you load your grain into your bin. After loading the best you can do is to try to maintain this level of quality. So, it is important to maximize the quality of your grain *prior* to storage. At harvest, for instance, make sure that your harvesting equipment is adjusted to minimize breaking or cracking the grain or beans.

Sanitation *is critical in on-farm grain storage. Only load your grain into a thoroughly cleaned, empty bin!* Thoroughly clean bins using brooms, brushes, compressed air, vacuuming to remove grain dust and debris and webbing (wear a dust mask!). Be sure to clean out seams and joints, inside hollow ladder rungs, and especially the ledge over the door. Clean out under perforated flooring (if possible), and be sure the fan and air duct are clean. It is best to do this right after the bin is emptied.
Not thoroughly cleaning out storage is not an option. Cover the fan when it is not in use. You may even want to use silicone caulk to seal seams. *Also* clean combines, grain truck beds, augers and other equipment that can be contaminated with grain and grain debris and dust and the insects that will infest them.

Don't load grains on top of older grains! Most of the calls I receive on stored grain insect and mite problems involved situations where storage had *not* been cleaned, and/or where new grain was loaded into storage on top of *old grain*. When loading grain into the storage bin make sure your loading auger and mechanical spreaders in the bin are in good condition and will not damage the grain when loading. Run the auger at full capacity (run at a slow speed) to minimize breaking the grain kernels or beans. And the cleaner and drier the grain is going into the bin the better.

Don't overfill the bin. Carefully level the grain in the bin as soon as it is filled and immediately begin aeration to cool the grain. Poorly controlled temperatures are the most important cause of stored grains going out of condition. Get the grain cooled down to the outside air temperature as soon as possible. This is especially challenging here in the south. Keep the bin temperature no more than 10 – 15°F below the outside temperature during storage to avoid condensation. Ideally the temperature should be maintained at 35 - 40°F.

As soon as bins are loaded, clean up *all* spilled grain. Keep ground around bins clear of weeds and debris.

Proper storage management provides the best control for the cost. Proper harvest, loading and storage of grain is critical for managing potential insect infestations. It is important in *any* insect management system to not rely solely on insecticides. This is particularly true for stored grains, as there are few insecticides registered in this use area, and fewer still for the individual stored commodities. Also, insecticide resistance has already made at least malathion essentially useless in many stored grain environments; malathion is not recommended (*and see notes below*.) Resistance to phosphine gas is increasingly common.

Insects will stop feeding and reproducing at temperatures below about 50°F. Because some grains, wheat and corn for example, are harvested when temperatures can still be fairly warm in South Carolina, immediate aeration to get harvested corn to ambient temperature is critical to help prevent insect infestations. Even grain, especially corn, held at the moisture levels that will not allow mold growth, can still be infested by at least Indian meal moth. This moth infests the grain from the top of the bin. Indian meal moth can be controlled using DDVP resin strips in the head space of the bin, using 1 strip per 1,000 cubic feet (controls adults only). Change strips every one to two months in hot weather, every three to four months after that. You may alternatively, or also, use a *Bacillus thuringiensis* (*Bt*) product (for example, Dipel) as a top dressing (grain surface treatment) applied immediately after bin loading (controls larvae only.) Diatomaceous earth products may also be used here but monthly treatments will be needed.

Properly loaded grain should be stored in thoroughly cleaned and surface-treated bins (bin surface treatment). A grain protectant can also be used when loading the grain. However, even if both of these procedures are followed, do not fail to regularly check your grain – check storage temperature and moisture levels, and for flying moths and for surface crusting. Remember that grain protectants have low volatility and don't penetrate grain kernels and so won't control insects feeding inside the kernels, and also usually don't kill eggs. Soybeans stored for short time periods may not need to be treated with a grain protectant; they are less prone to insect attack by other than surface feeders than other grains. Before you use grain protectants, check with your buyer(s) to see what materials may or may not be acceptable to them for their markets. Grain with below U.S. pesticide residue tolerances may still not be acceptable to some buyers, and may not be acceptable for sale or use outside of the U.S.

Remember that grain protectants **cannot** *replace good initial storage preparation and thoroughly cleaned equipment and bins*, and that *top-dressing* **cannot** *replace grain protectants*.

These recommendations are based on active ingredients. These recommendations are not *a substitute for carefully reading and following the pesticide label and any other required product labelling. Other registered products not mentioned may be as effective.*

Pest or Application Type	**Active Ingredient(s) (Products)**	**Rates** ***READ and FOLLOW the LABEL INSTRUCTIONS***	**Site(s)**	**Re-entry Interval** (REI)	**Comments** (*And see Notes after this table*)
Bin Repair & Sanitation			Interior *and* exterior of grain storage bins prior to loading.		***Sanitation is critical.*** Repair (fix and fill holes, cracks) and *thoroughly* clean bins before loading with grain. *Most pesticide product labels note sanitation as a pre-treatment requirement!*
Empty Bin Residual Sprays (Bin interior and/or exterior surface treatment)	*beta*-Cyfluthrin (Tempo Ultra WP, Tempo Ultra WSP, Tempo SC Ultra) IRAC Group 3A insecticide	Spray empty, cleaned bin to run-off with low pressure sprayer ("garden sprayer" - less than 50 psi) with flat fan nozzle tip. One gal. spray covers 750–1,000 sq. ft.	Interior and exterior of empty bin surfaces	When sprays have dried	*Do not treat grain* with Tempo products. Do not treat bins with Tempo products that will store soybeans Do not spray electrical equipment!
	Chlorpyrifos-methyl IRAC Group 1B insecticide + deltamethrin Group 3A insecticide (Storcide II)	1.8 fl. ozs. for 1.0 gal. of spray solution for 1,000 sq.ft.	Exterior and *interior of empty bins	When sprays have dried	*Application *from outside* of bin. *Must be applied from the outside only with downward spray with high-pressure hand or automated equipment.* Close off all points of entry during application.
	Diatomaceous earth (DE) (Insecto)	1 lb./1,000 sq. ft. of surface	Empty grain bins & crack and crevice	When sprays have dried	Applied through aeration fan. May meet organic requirements.
	(*s*)-methoprene (Diacon-D IGR) IRAC Group 7A insecticide	1.5 oz./1,000 sq. ft. surface area	Empty bins & crack and crevice		*Controls larvae only.*
	Deltamethrin (Centynal)	0.25 – 1.5 fl. ozs. for 1 gal. solution			

Empty Bin Treatment *(continued)*	IRAC Group 3A insecticide	for 1,000 sq. ft. of bin surfaces. Perimeter spray 2-3 ft. up outside foundation and 6-10 ft. band out on ground	Empty bins; perimeter treatment		Fumigate empty bins. Apply Centynal for residual control. Do not allow runoff to occur or product to enter any drain during or after application. Can tank mix with Diacon IGR. See labels.
	Pyriprooxyfen/ (Nylar) - (NyGuard) IRAC Group 7C insecticide	Surface spray - 4 ml-11 ml/gal. for 1,500 sq. ft.	Empty bins		Insect growth regulator - Can tank mix with registered adulticide (*not with malathion or vapona*)
Empty Bin Fumigation	Aluminum phosphide - phostoxin gas (Phostoxin; Phosfume; Weevil-cide; pellets /tablets) IRAC Group 24A insecticide	Read and follow label AND applicator manual instructions exactly. *The complete label for these products consists of the cohntainer label and the applicator's manual.* Read the SDS.	Empty bins; insects infesting stored crops	*Follow label, applicator manual proceduresexactly*	Fumigate empty bin after *thorough* bin clean-out and interior residual treatment. Extremely toxic RUP with strict application procedures. No residual control.
	Sulfuryl fluoride gas (Profume) IRAC Group 8C insecticide	Profume for use only by licensed fumigators trained under Dow AgroSciences' PRECISION FUMIGATION Program	Empty bins; Insects which infest stored crops	*Follow label, product applicator manual all products.*	*Extremely toxic RUP.* Strict application procedures fumigant detection, other measures.
Pest or Application Type	**Active Ingredient(s) (Products)**	**Rates** ***READ and FOLLOW the LABEL INSTRUCTIONS***	**Site(s)**	**Re-entry Interval** (REI)	**Comments** (*And see Notes after this table*)
Grain Protectants (Direct grain / Admixture treatment)	Pirimiphos-methyl (Actellic 5E) IRAC Group 1 insecticide	9.2 – 12.3 fl.ozs. (6 – 8 ppm) in 5 gal. water /1,071 bu. (30 tons)	Corn, grain sorghum *only*	When sprays have dried	One (1) treatment per load of grain only. Use calibrated applicator.
	Deltamethrin (Centynal) IRAC Group 3A insecticide	7.3 – 9.1 fl. ozs./5 gal. water/1,000 bu. *See label for grain specific rates*	Barley, corn, oats, rye, milo Wheat		May tank mix with Diacon-IGR. See label for treating stored grains, seed.
	(*s*)-methoprene	1 to 7 fl. oz product/5 gal.			

Grain Protectants *(continued)* 	(Diacon IGR) IRAC Group 7A insecticide	water/1,000 bu. grain *or* 0.0625 – 0.25 oz a.i./ton of commodity– rate varies with length of protection needed and kind of grain, seed – *see label.*	Any food or feed commodity	When sprays have dried	Pre-treat storage facilities before filling with DIACON IGR treated commodities. (*s*)-methoprene *Is an nsect growth regulator - controls larvae only.* May be used with adulticides; see label
	(Diacon-D IGR) IRAC Group 7A insecticide	8-10 lbs product/ 1,000 bu. of commodity	Any food or feed commodity		Higher rates give longer residual
	Chlorpyrifos-methyl IRAC Group 1B insecticide + deltamethrin (Storcide II) IRAC Group 3A insecticide	6.6 fl oz./1,000 bu Oats 9.9 oz. /1000 bu Barley 12.4 oz./1000 bu Wheat 12.4 fl. ozs. / 1,000 bu. (For five (5) gals. of solution (3.0 ppm chlorpyrifos methyl and 0.5 ppm deltamethrin) /1,000 bu. grain) *see label*	Wheat, barley, oats, milo, rice, seeds with in-storage tolerances		One (1) treatment per load of grain only. Use calibrated applicator. *U.S. marketed grain only.* ***Not labeled for corn or soybeans.*** Do not allow runoff to occur or product to enter any drain during or after application. Can tank mix with Diacon IGR. See labels.
	Diatomaceous earth (DE) Insecto)	1- 2 lbs./ton of grain to top 2-3 ft. of grain.	Any food or feed commodity		May meet organic requirements. Treatment varies with time of harvest, anticipated storage time.

Pest or Application Type	Active Ingredient(s) (Products)	Rates *READ and FOLLOW the LABEL INSTRUCTIONS*	Site(s)	Re-entry Interval (REI)	Comments (*And see Notes after this table*)
Grain Top-Dressing (Stored grain surface treatment, especially for Indian-meal moth larvae-*Applications are to leveled grain*)	Pirimiphos-methyl (Actellic 5E) IRAC Group 1B insecticide	3 fl. oz/2 gal. water/1,000 sq. ft. (3.0 ppm). See label	Corn, grain sorghum *only*.	When sprays have dried	Clear webbing, break-up crusting. Apply 1 gal. and rake into top 4 inches of grain; apply second gal. to raked surface. Use only enough water for coverage – *Do not flood top-dress area.* Controls larvae only.
	(*s*)methoprene (Diacon IGR) IRAC Group 7A insecticide	0.2 teaspoon or 1.0 ml./1,000 sq. ft. *or* .6 tsp. or 3.0 ml./10,000 cu. ft. in sufficient diluent	Any commodity		Apply also to headspace ceiling, beams, etc. Rake to depth of 1 foot. Do not flood top dress area. *Controls larvae only.*
	(Diacon-D IGR) IRAC Group 7A insecticide	8 lbs. product /1,000 sq.ft.	Any commodity		Dust headspace beams, etc. & top dress; rake into 1 foot
	Bacillus thuringiensis (*Bt*) (Biobit HP, Dipel DF, Javelin WG) IRAC Group 11A insecticide	1 lb./10-20 gal. water/1,000 sq. ft.; *see label*	Any commodity		Apply to surface and rake into top 4 inches of grain; see label instructions. *Controls only larvae*. May meet organic requirements.
	Diatomaceous earth (DE) (Insecto)	4 lbs./1,000 sq. ft.	Any commodity		Especially for Indian-meal moth. May require second application for heavy infestation. *Apply at monthly intervals*. May meet organic requirements.

Filled Bin Fumigation *These materials are extremely dangerous to use. You must follow all label and applicator manual instructions and procedures.*	Aluminum phosphide - phostoxin gas (Phostoxin; Phosfume; Weevil-cide; pellets or tablets) IRAC Group 24A insecticide	*Follow label, product applicator manual exactly*	Insects which infest stored crops	*Fumigant detection, post-treat ventilation*	*Extremely toxic RUP.* Strict application procedures including placarding, fumigant detection, other required measures.
	Sulfuryl fluoride gas (Profume) IRAC Group 8C insecticide	Profume for use only by licensed fumigators trained under Dow AgroSciences' PRECISION FUMIGATION Program	Insects infesting stored crops	*Follow label, product applicator manual all products.*	*Extremely toxic RUP.* Strict application procedures fumigant detection, other measures. *Do not use this product without Fumiguide Program for Profume*

***Note*: Product use sites** - *Read the label carefully!* Use sites vary widely from product to product. Some products may only be used to treat grain storage bin surfaces and not grain; few products may be used for both applications. Which grains that may be treated, including stored grain seed, also vary widely across products. See the product labels.

***Note*: Product rates** - *Read product labels carefully!* Rates vary with formulation of product used, use site/crop being stored, anticipated storage time, and pest species, and pest development stage. Some grain protectants may only have one (1) application made per load. Period of control varies with pest insect species and is shortest at the lowest rates.

***Note*: Pests controlled** – Read the label. Not all products control all pests, especially at the lowest rates. Insect growth regulators (IGRs), such as Diacon IGR, Diacon-D IGR, NyGuard, and *Bacillus thuringiensis* (*Bt*) products control only immature stages (larvae, caterpillars, grubs). Control will be slow. *Bacillus thuringiensis* controls only caterpillars (moth larvae), and not beetle grubs. Some IGRs may be tank mixed with some registered insecticides controlling adults (adulticides). See the labels. When tank mixing products most stringent label applies.

***Note*: Formulations** – Read the label. Choose the correct formulation. Be sure you have the necessary application and safety equipment and PPE to make an application with the product formulation you consider. Some formulations may not be applied directly to grain. Some products may be applied with water or food-grade oil or soybean oil, usually except for peanuts and rice. See labels.

***Note*: Actellic 5E** (IRAC Group 1B insecticide) – only one (1) application method is allowed per load. Only one (1) application allowed per load. Corn and grain sorghum only.

***Note*: Diacon IGR** (s-methoprene) – (IRAC Group 7A insecticide) – Insect growth regulator controlling larvae only. Lowest rates give control for less than 6 months. May be applied with water or food-grade oil or soybean oil, except for peanuts and rice. Product may be applied with an insecticide controlling adults, such as Centynal (deltamethrin). Read the label(s). **NyGuard** (pyriprooxyfen/Nylar) (IRAC Group 7C insecticide) – also may be applied with an adulticide. When tank mixing products most stringent label applies.

***Note*: Insecto** (a diatomaceous earth product) – "Insecto Control Plan" calls for dusting the empty bin, treating the bottom 2 feet of grain, treating the top 2 feet of grain, top-dressing leveled grain with this product at labeled rates. Inspect grain bi-weekly. Organic Materials Review Institute (OMRI) Listed.

***Note*: Fumigants** are the most effective way of controlling insect infestations in stored grain; however, fumigants provide *no* residual control. Fumigants are Restricted Use Pesticides (RUPs) and may be purchased and used only by licensed applicators. These pesticides are Danger, Danger/Poison labeled because of acute toxicity. Fumigants have strict application requirements via the label and applicator manual. Product-specific training and/or product company supervision may be required, especially for liquid and gas formulations. Some empty bin and other products call for fumigantion of bins first.

***Note*: Malathion** (IRAC Group 1B insecticide) – is registered for empty bin treatments (labeled *EC formulations only*) and for grain protectant treatments (labeled *dust formulations* only). However, malathion is not being recommended here as it is not seen as reliably effective because of wide-spread resistance to it, especially the Indian-meal moth. Further, international tolerances for malathion on grain are now much lower than U.S. tolerances, effectively making malathion treated grain unmarketable outside of the U.S. Grain buyers often will not accept grain treated with malathion.

Grain Bin Surface Areas and Capacities *R.G. Bellinger*

Bin Diameter (Feet)	**Grain Head Surface Area or Bin Floor Area** (Square feet)	**Approximate Surface Area of Empty Bin** (Square feet)	**Bushels per Foot of Bin Height**	**Approximate Bin Head-space** (Volume of a cone - cubic feet)
15	177	(Bin Height x 47) + 354	141	59 x cone height
18	254	(Bin Height x 57) + 508	204	85 x cone height
21	346	(Bin Height x 66) + 692	277	115 x cone height
24	452	(Bin Height x 75) + 900	362	151 x cone height
27	573	(Bin Height x 85) + 1146	458	191 x cone height
30	707	(Bin Height x 92) + 1400	566	236 x cone height
33	855	(Bin Height x 104) + 1710	685	285 x cone height
36	1,018	(Bin Height x 113) + 2000	815	339 x cone height
42	1,385	(Bin Height x 132) + 2770	1109	462 x cone height
48	1,810	(Bin Height x 151) + 3,620	1448	603 x cone height
54	2,290	(Bin Height x 170) + 4580	1833	763 x cone height
60	2,827	(Bin Height x 188) + 5654	2263	942 x cone height

Pesticide Recordkeeping Form

Name and Certification Number	Application Date*	Brand or Product Name	EPA Registration Number	Size of Area Treated	Rate Per Unit**	Total Amount Applied	Location	Crop

Notes:_____

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DEPARTMENT OF PESTICIDE REGULATION

Website: http://www.clemson.edu/public/regulatory/pesticide_regulation/

The Department of Pesticide Regulation (DPR) is the South Carolina regulatory and investigative agency for pesticides. The DPR enforces the South Carolina Pesticide Control Act (SCPCA), the South Carolina Chemigation Act (SCCA), the state groundwater plan, as well as the Federal Pesticide Recordkeeping Requirement and the EPA's Worker Protection Standard (WPS) and the Fish & Wildlife Service's Endangered Species Program. The DPR also registers pesticides for South Carolina, licenses pesticide applicators and pesticide dealers, and performs quality assurance analysis of pesticide formulations

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Public Service Activities